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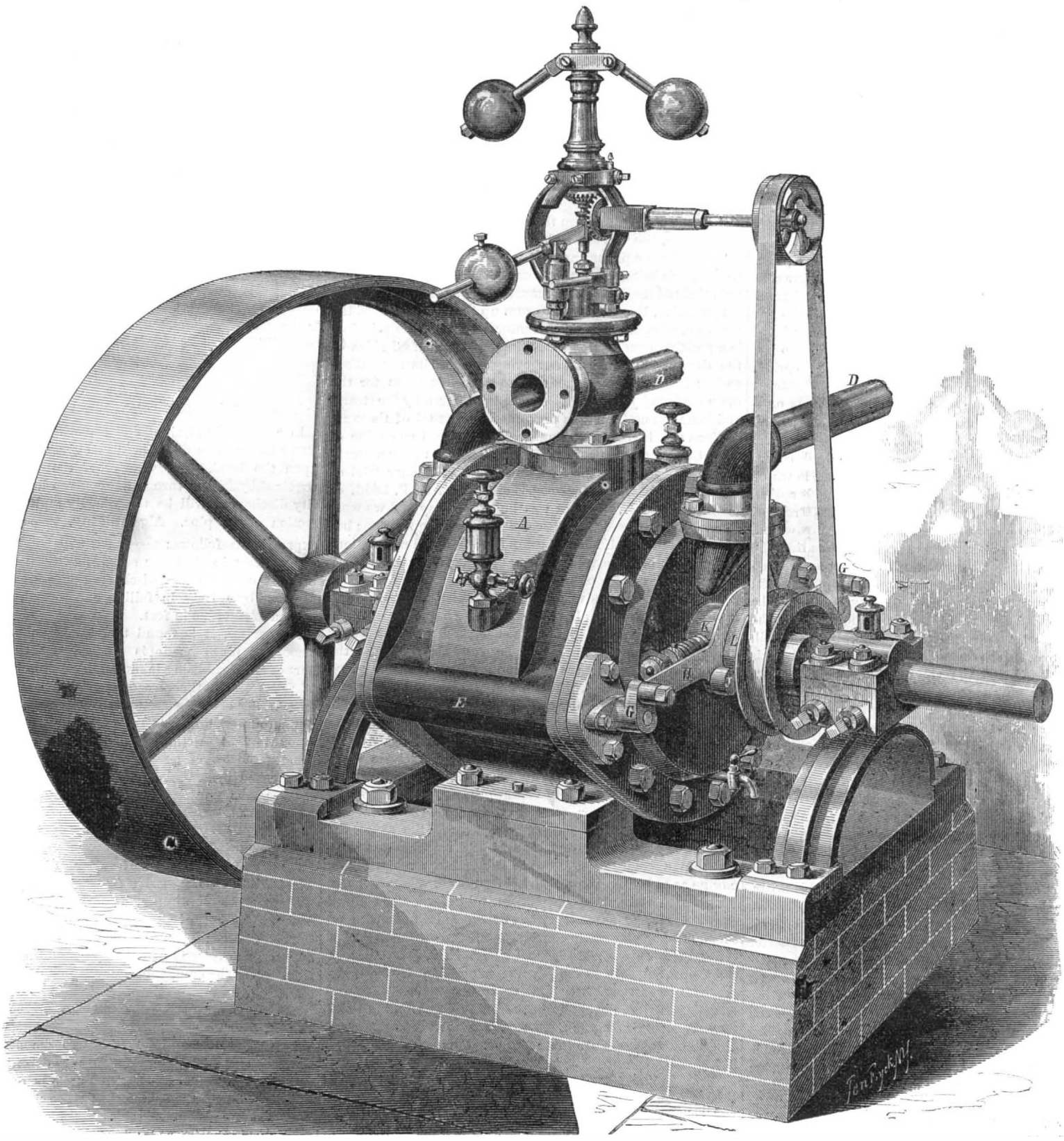
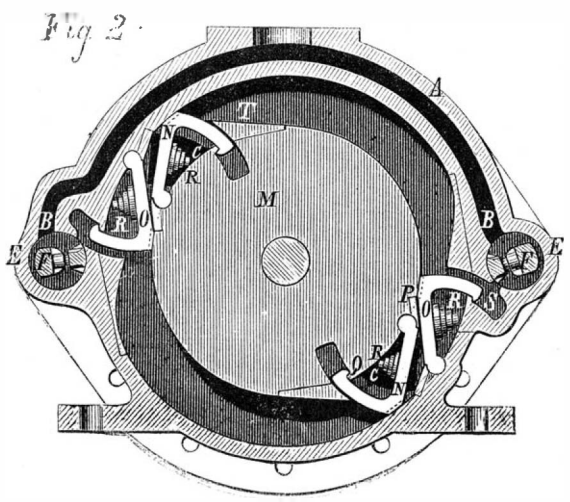


## THE BALTIMORE CONCENTRIC ROTARY ENGINE.

### THE BALTIMORE CONCENTRIC ROTARY ENGINE.

It is hardly necessary, at the present day, to direct especial attention to the relative proportion of advantages and defects inherent to the rotary engine as a type; nor is it here needful to draw any contrast between it and the reciprocating engine. Although having the merits of compactness and lightness, and generally that of cheapness, which render it admirably adapted to certain requirements, the rotary is in comparative infancy; and hence, while, in the future, inventors will unquestionably seek to augment its advantages, at present their efforts are more particularly directed toward overcoming the practical difficulties which militate against its employment to an equal extent with its older rival.

Fig. 2.




The principal obstacles to be surmounted, as we have before remarked in referring to engines of this class, are those in the way of using steam expansively with a variable cut-off and without undue clearance, and also in the reduction of frictional loss to a minimum by prevention of wear and by perfect equilibration of working parts. These, by proper means, once overcome, it is clear that an advance of no small importance will be effected, and an engine produced manifestly capable of coping with the best reciprocating machines of equal power, as regards durability, efficiency, and in point of economy of fuel.

The inventor of the device, to which in the following description we propose particularly to refer, has, he states, conceived the same with a full knowledge of the matters wherein the older forms of rotary engines have been found wanting. How he has succeeded in avoiding such difficulties is a subject for the intelligent judgment of the reader; though it is a matter of regret that the short period which has elapsed since the completion of the invention, has precluded the making of necessary competitive trials, and the consequent formation of opinion upon a basis other than that afforded by a careful examination into the construction and general operation of the machine.

Fig. 3

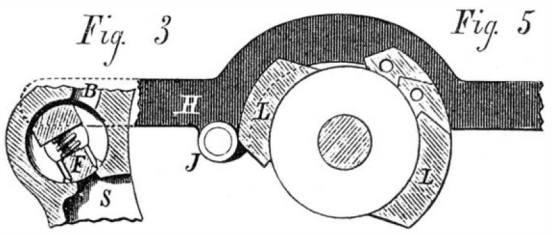
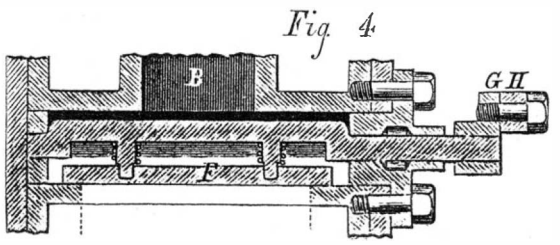



Fig. 5




Fig. 4

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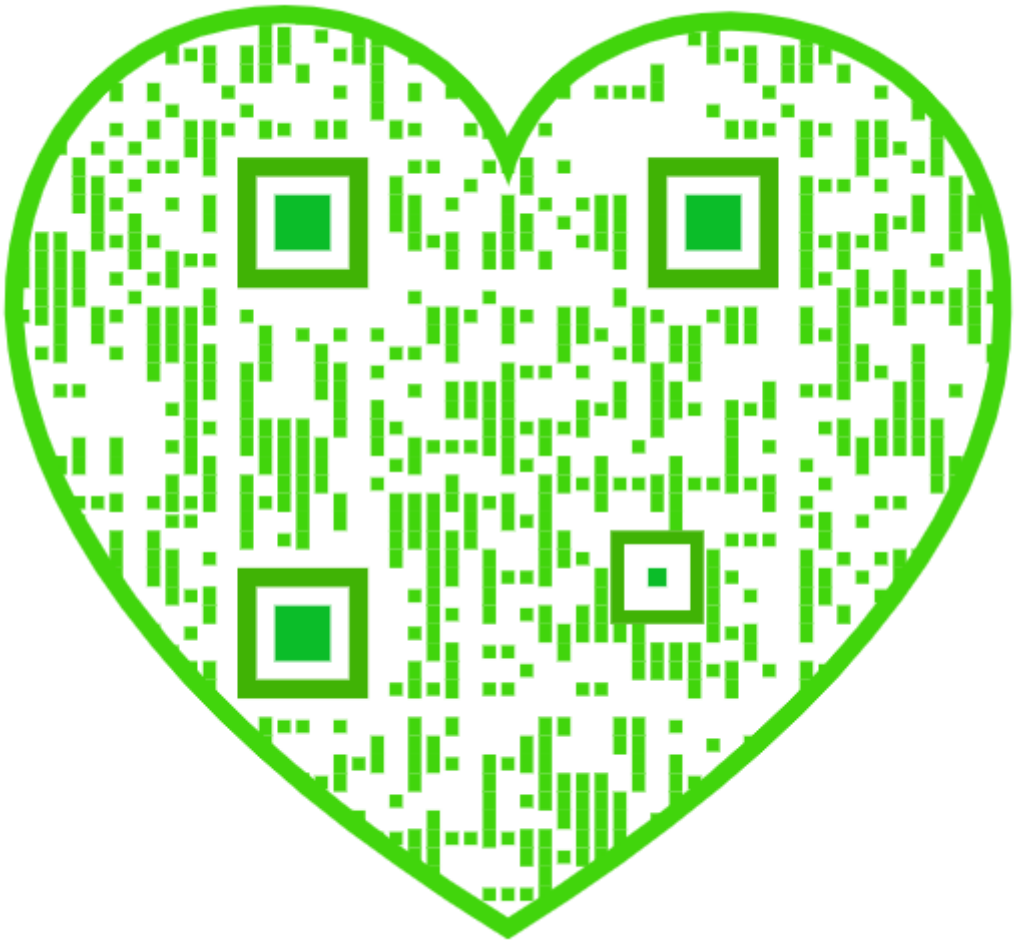

Referring to the foregoing engravings in illustration of our subject, Fig. 1 affords an excellent idea of the exterior appearance of the engine, and the smaller drawings, Figs. 2, 3, 4, and 5, relate to especial parts which will be adverted to as we proceed.

The concentric cylinder or casing, A, is bored out smoothly to form a perfect circle within, and is pierced at either side with induction ports, B, Figs. 2, 3, and 4, which extend across the rim, forming narrow slits of about half an inch in width. At C, Fig. 2, are shown the exhaust openings, of which there are four, two on each face, and which together aggregate in area four times that of the induction ports. A steam jacket, represented in section in the upper portion of Fig. 2, incloses the top of the case so that the steam, entering by the pipe from above, is supplied to both induction ports at once. The exhaust passes through the openings above noted, into annular chambers, and thence exits by the pipes, D.

A E, Figs. 1 and 2, are the steam chests communicating with the jacket and containing the valves, F, the form of the latter being more clearly shown in Fig. 4. It will be here observed that the two parts of the valve are separated by springs, and that the outer part is made in the segment of a circle (see section in Fig. 3) to fit the chamber, against which the springs hold it. The valve journals are arranged as shown, one resting in the cover and the other passing through and terminating in a short crank, G. The construction is of course the same in both valves.

Between the cranks, G, extends a horizontal bar, H, Fig. 1, the portion of which passing over the shaft is shown in Fig. 5. On this bar is a small projecting roller, J, and formed on its inner side are other projections. The lug on the left side of the bar, or that nearest the reader, is perforated and travels on a horizontal screw-threaded bar, secured to the head of the casing. Also inclosing this bar is a spiral spring, K, which presses against the lug. On the opposite side of the bar, H, another projection, not shown, also travels on a screw-threaded rod held in fixed standards, on which, however, are nuts which can be turned forward or back on the screw so as to limit the play of the projection and consequently the horizontal movement of the bar, H, to which the latter is secured. On the shaft of the engine is a disk, L, Figs. 1 and 5, shown in the former figure just in rear of the governor pulley, on which are formed two cams which, in the revolution of the disk, press upon and push aside the roller, J. The motion of the valves is therefore governed as follows: Rotating the disk throws the roller, J, to the left; the spring, K, is consequently compressed by the lug on the bar, H, being carried against it. As soon, however, as the cam pressure relaxes, the spring acts and, by its recoil, throws the bar over in the opposite direction, so that by this means the cranks, G, and the valves attached thereto, are moved. Referring now to Fig. 5, on the left side of the right hand cam will be noticed a number of additional pieces. These are movable blocks bolted on and easily adjustable, which serve to increase the length of the cam so as to control the points of time of opening the valves and admitting steam. When it is desirable to cut off earlier, with reference to the revolution of the drum within, more of these blocks are added; and when a more continuous supply of steam is needed, some are removed. The ready manner in which the cutting off can thus be regulated is, we think, an ingenious and novel improvement.

Through the action of the lug and nuts on the right of the bar, H, in governing the horizontal play of the latter, it is clear that the apertures of the induction ports are also thus regulated, for necessarily, if the cranks, G, are carried over a shorter distance, the valves are moved over diminished space. By this means the induction orifices can be arranged to admit steam to their full capacity, or to allow it to enter in the thinnest possible sheet, so to speak, in accordance with the power and work required of the engine. The same device can also be made to afford an extremely sensitive variable cut-off, by connecting the governor with a movable wedge which will thus, by entering more or less, shorten or lengthen the play of the bar, H, and thus automatically control the valves in their motion over the very narrow ports. These changes, the alteration of the cams and the nuts on the sliding bar, it should be noticed, are all easily accomplished in a moment, from the fact that the parts are outside the machine, and hence directly at the hand of the engineer.

In Fig. 2 the interior arrangements are clearly depicted; M, the revolving drum, is secured to the shaft, and its length is very nearly that of the case, so that its ends when rotating are in such close approximation to the latter that steam is prevented from passing between. The weight of this drum is such and it is so constructed as to act as a balance wheel with equal momentum throughout its entire revolution. The pistons, N, and abutments, O, against which the steam presses, are located in the space between the drum and cylinder. The pistons, N, are hinged by their cylindrical ends in projections, P, screwed to the drum, which form sockets. From these extremities the pistons are flattened for a certain distance, sufficient, when at a proper angle, to cause them to close the space. Their width is such as to permit their front or loose ends to extend across and completely fill the said space, while their extremities enter slots formed in the drum. These slots are provided with shoulders, at Q, which the flanged ends of the pistons take against, so that when the latter are lifted by the springs, R, under them (which are made only just strong enough for such purpose) or by steam entering beneath, they will be caught and prevented from being forced up so as to cause undue friction between their upper surface and the inner periphery of the cylinder. The wearing edge of each piston is faced with steel, as indicated by the dotted lines, the plate being screwed on and easily removable. In order to obtain access to this part of the engine for alteration or repairs, it is only necessary to remove the head of the cylinder and draw the pistons laterally from their positions by hand, an operation very quickly and easily performed.

The abutments, O, fixed on the case are arranged similarly to the pistons, their movable ends entering slots, S, and steam passing along their outer sides. It will be observed that the pistons come under these abutments, so that each moves through one half the space between the drum and cylinder, while they laterally entirely and closely occupy the chamber. All jar and consequent wear due to sudden contact is ingeniously obviated by a nice arrangement of working parts; thus, supposing the drum to turn from right to left, the abutment, O, is first met by the inclined projection, P, which slides under and is prolonged by the flat portion of the piston, N, which is followed by another inclined projection, T, secured to the drum. By this means the parts which travel under the abutment are inclined planes, which readily slide by without jar. Similar arrangements, it will be noticed, are provided in connection with the abutments to prevent sudden contact of the pistons with the cylinder.

The operation of the engine can now be easily comprehended. Steam entering at the top passes through the jacket, thence through the ports, and thence, entering the cylinder, actuates the drum. In Fig. 2 the pistons are shown near the end of the stroke. Before their faces have reached the exhaust ports, the valves will have closed, thus cutting off the steam while the pistons are passing the abutments. The exhaust ports being open, the moment the faces of the pistons pass their edges the steam exhausts.

It remains, in conclusion, to sum up the advantages of the machine, as claimed by the inventor. Of these the principal is a positive equalization of steam pressure, on all sides of the drum, at all times and at every point of its revolution, so that frictional wear is reduced to its lowest point for the main shaft and journals. The drum is balanced by the steam, and hence its oscillation is prevented. In proof of these assertions the inventor, in our presence, caused an engine of some thirty horse power to start and operate under a steam pressure of less than half a pound. From further trial of the machine at the Ridgewood Works of Mr. C. P. Ladd, of Bloomfield, N. J., where it was built, we may add we were favorably impressed with its construction and operation; but of course, in the absence of complete tests and calculations as to power, etc., we are unable to speak, with such certainty as we should desire, of its probably high efficiency.

Further points of advantage may be briefly stated as follows: Cheapness, as all the parts are simple lathe work, strictly circular, or else have flat and straight edges easily planed; compactness; economy of fuel, because the driving power is always at the same leverage from the center of the main shaft, and, through the cam, steam may be employed expansively to any extent compatible with length of stroke or size of engine, according to the horse power required for the work to be done; simplicity and ready accessibility of working parts; practically no appreciable clearance; capability, from its plane surfaces, of being packed as readily as a reciprocating engine; lastly, and especially claimed by the inventor, owing to the machine being concentric and the steam space being uniformly the same, the amount of steam used can be cubically calculated so as to institute a comparison between this and the reciprocating engine as to bulk of steam used and power developed. There are other matters, mostly of theoretical nature, also claimed to prove further advantage, but owing to lack of space we are obliged to omit their consideration.

Patented July 23, 1872, by Colonel E. P. Jones, one of the Commissioners to the Vienna exposition from Mississippi. For further particulars regarding proposals for construction, rights, etc., address the manufacturers, the Baltimore Concentric Engine Company, General Wade Hampton, President, care of Carolina Insurance Company, Baltimore, Md.

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## FRICTION OF WATER IN PIPES.

In a perfectly straight and smooth pipe, the quantity of water that will be discharged in a given time depends only upon the head. The velocity of the water will be that acquired by falling through the given head, and the quantity discharged will be the velocity multiplied by the cross section of the pipe. Algebraically, these results will be expressed as follows: $v^2 = \sqrt{2gh}$, and $Q = v \times S$, where $v$ is the velocity in feet per second, $h$ the head in feet, Q the number of cubic feet discharged per second, $g$ the velocity acquired by a body in falling one second, and S the cross section of the pipe in feet.

In practice, it is found that the actual velocity with the smoothest pipes made is much less than the theoretical, part of the head being taken up in overcoming the resistance of friction. In the case of curved pipes, there is another loss of head, and consequently of velocity, at each bend. Numerous experiments have been made to determine the amount of this frictional resistance, and formulas have been constructed from the results. These formulas should always be checked by actual experiment, when great accuracy is required, as the results are greatly altered by seemingly unimportant details. Our object, in this article, is to give the best and simplest formulas for general use. Very good tables, showing the amount of water discharged under different heads from pipes of various diameters and lengths, will be found in Trautwine's "Engineer's Pocket Book."

For smooth iron pipes, Prony's formula is as follows: $h = 0{\cdot}00040085 \times L \div d[(v + 0{\cdot}15412)^2 - 0{\cdot}02375)]$, which may be thus translated: To find the necessary head of water to produce a given velocity of discharge, add 0·15412 to the velocity, square the sum, subtract 0·02375, and multiply the difference by 0·00040085 times the length of the pipe divided by the diameter, noting that all dimensions are to be taken in feet.

In 1858, some very interesting experiments were made by the Brooklyn Water Commissioners to determine the friction in pipes, the pipes experimented upon being very much corroded by long use; and, from the data so obtained, Prony's formula was modified to meet this case. The formula constructed from their experiment is: $h = 0{\cdot}00046749 \times L \div d(v + 0{\cdot}397)^2$, or: To find the head corresponding to any required velocity, add 0·397 to this velocity (expressed in feet per second), and multiply the sum by 0·00046749 times the length of the pipes divided by the diameter, in feet. For ordinary use, a much simpler formula, by Mr. Lane, will answer: $h = 0{\cdot}000625 \times L \div d \times v^2$, or: The required head equals the square of the velocity multiplied by 0·000625 times the length, divided by the diameter of the pipe, all measurements being taken in feet.

Knowing the actual head required for any velocity of discharge, we can readily ascertain the head required to overcome friction, and consequently the increased pressure necessary, in pounds per square inch. Thus, the theoretical head (disregarding prejudicial resistances) necessary to produce a given velocity is found by dividing the square of the velocity by 64·4; or, expressed algebraically, the formula is $h = v^2 \div 2g$, and the difference between the actual and theoretical head is the amount required to overcome friction. The pressure per square inch required to overcome this friction is equal to the weight of a column of water of one inch cross section, and with a hight equal to the ascertained head.

In order to render the preceding remarks more intelligible, we will assume data and work out an example by each formula. Length of pipe = 100 feet, diameter of pipe = 3 inches. Required velocity = 2 feet per second. By Prony's formula:

Required head $= 0{\cdot}00040085 \times 100 \div {\cdot}25 \times [(2 + 0{\cdot}15412)^2 - 0{\cdot}02375)] = 0{\cdot}74$ feet.

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By Brooklyn Water Commissioners' formula:

Head $= 0{\cdot}00046749 \times 100 \div 25 \times (2 + 0{\cdot}397)^2 = 1{\cdot}07$ feet. In this case, the pipes being very much corroded, the resistance is greater, and more head is necessary.

By Lane's formula: Head $= 0{\cdot}000625 \times 100 \div 0{\cdot}25 \times v^2 = 1$ foot. (Pipes in average condition).

A correspondent has asked us what is the difference of friction in a pipe, under 15 pounds pressure and under 150. We will use Lane's formula in making the necessary computations for the answer, though the same method would answer with either of the others.

A column of water, to have a pressure of 15 pounds per square inch, must be about 34·6 feet high. We will assume the diameter of the pipe to be 6 inches, and the length to be 500 feet. Then the formula gives: $34{\cdot}6 = 0{\cdot}000625 \times 500 \div 0{\cdot}5 \times v^2$. From which we find that $v = 7{\cdot}44$ feet per second. The theoretical velocity corresponding to a head of 34·6 feet is equal to the square root of 64·4 multiplied by 34·6, or 47·2 feet per second, and the theoretical head necessary to produce a velocity of 7·44 feet per second is the square of 7·44 divided by 64·4, or about 0·86 feet; so that the head necessary to overcome friction is 34·6—0·86 = 33·74 feet, and this produces a pressure of about 14·6 pounds per square inch.

In the second case, when the pressure on the pipe is 150 pounds per square inch, the head of water will be about 346 pounds per square inch; and substituting this value in the formula, we have: $346 = 0{\cdot}000625 \times 500 \div 0{\cdot}5 \times v^2$. From which we obtain: $v = 23{\cdot}53$ feet per second. The theoretical head required for this velocity is the square of 23·53 divided by 64·4, or about 8·6 feet; so that the head necessary to overcome friction is 346 — 8·6 = 337·4 feet, which corresponds to a pressure of about 146·2 pounds per square inch. By comparing the velocities under the two given pressures, it will be seen that the velocity is about 3·16 greater in the second than in the first case, while the pressure necessary to overcome friction is 10 times as great in the second case. Now the square of 3·16 is about 10, and we say that friction in pipes increases as the square of the velocity of discharge. We hope we have succeeded in making this matter plain to our readers. We have given them formulas which apply to the flow of water in iron pipes under various conditions, these formulas embodying the results of the most reliable researches on the subject.

## THE ZODIACAL LIGHT.

The name zodiacal light is given to a faint nebulous appearing radiance, which, at certain seasons of the year, and especially within the tropics, is seen in the west after twilight has ended or in the east before it has begun. The light is conical in shape, the breadth of the base varying from 8° to 30° in angular magnitude, and the apex being sometimes more than 90° to the rear or in advance of the sun.

Very many theories have been adduced to account for the phenomenon. Kepler supposed it to be the atmosphere of the sun. Cassini considered it as a lenticular solar emanation, and Mairan believed it a reflection from the sun's atmosphere, stretched out into a flattened spheroid. La Place, however, founded the theory which astronomers have generally adopted, and in his *Systéme du Monde* he pronounced it a nebulous rotating ring, situated somewhere between the orbits of Venus and Mercury. It is unnecessary to enter into any discussion of these earlier views, as probably the best records extant which tend to explain the nature of the phenomenon are the observations of the Rev. George Jones, chaplain of the United States Japan Expedition, made on the Pacific Ocean, over an uninterrupted period of two years from April, 1853. Of these we give below the general conclusions in order that the reader may compare them with the theory of a correspondent, Mr. T. R. Lovett, which will be found, with an explanatory diagram, on another page of this issue. We may here remark that the idea therein stated, ascribing the zodiacal light to the reflection of the rays of the sun from the atmosphere, seems to us plausible, particularly as it accounts quite clearly for portions of the phenomena especially noted by Mr. Jones. The pulsations or intermittent variations in luster of the radiance, observed by Humboldt and others, our correspondent ascribes to refraction in the body of the atmosphere, or irregular motion of its surface. Mr. Jones, in referring to the same appearance, speaks of two distinct degrees of luster, a triangle within a triangle, the boundaries of which could be detected. It will be observed, on examining the explanation of the new theory, that these two triangles may be accounted for by the observer seeing both base and elevation of the spherical triangle, reflected from earth to atmosphere and thence to the eye. Again Mr. Jones states that when his position was north of the ecliptic the main body of the light was on the north side of the line, and conversely when he was south of the sun's apparent path; but when he was on or near the ecliptic, the light was equally or nearly divided by that line. Our correspondent's views agree with this, for he considers that when the spectator is in the plane of the ecliptic, that is, when the latter is perpendicular to his horizon, it is the only period when he can see the double light pyramids at east and west at the same time. Mr. Jones says that at midnight he saw the light simultaneously on both eastern and western horizons, which also agrees with the second proposition of Mr. Lovett. The remainder of Mr. Jones' conclusions ascribe the phenomenon to a nebulous ring similar to that which surrounds the planet Saturn. He considers the change of shape of the light due to change of horizon attributable to new portions of nebulous matter coming into position to give visible reflection, while portions lately visible were no longer capable of giving such reflection. The change of shape he believes based on a principle similar to that of the rainbow, the arch of which is new with every alteration of position. Hence the parallax of the light cannot be found. This may be compared with our correspondent's first conclusion.

Mr. Jones alludes to the reflection from the atmosphere theory, but does not believe that the light takes its shape from such cause, because "the lenticular elongation of the earth's atmosphere, consequent upon diurnal rotation, must be directly over the earth's equator; while the course of the zodiacal light shows not the slightest affinity for this line." The other conclusions point out that, as a nebular ray, it cannot lie between the orbits of Mercury and Venus as shown by La Place, that it must be something continuous and unbroken, that Mairan's theory above given cannot be true, that the substance of the light cannot be very remote from the earth, owing to its alteration of outline due to change of observer's position, and that it seems full of internal commotions.

## THE GREATEST GAS WELL IN THE WORLD.

The Newton gas well, six miles from Titusville, Pa., discovered last year, still continues to pour forth its gaseous treasures at the rate of three millions of cubic feet of gas every day of twenty-four hours. The gas issues under a pressure of from twenty to thirty pounds per square inch, and for the most part goes to waste. Pipes have been laid to Titusville, and some two hundred and fifty dwelling houses, shops, etc., are now supplied with the gas for illumination and fuel. For heating purposes it is admirable, but for illumination it requires to be passed through naphtha, as it is deficient in carbon.

This well may be justly regarded as one of the wonders of the world. If the bowels of the earth in its vicinity were transparent, and the owners could satisfy themselves of the continuity of the gas flow, we presume that pipes would be laid from the well to several of the large cities, such as Pittsburgh, Cleveland and Buffalo, distant from 130 to 150 miles.

We have heretofore published accounts of the gas wells at Painesville, Ohio, and other places. But we believe that the quantity of gas delivered by the Newton well exceeds the combined supply derived from all other wells in the country

## TO EUROPE BY BALLOON.

We publish on another page a variety of particulars concerning the construction of the great *Graphic* balloon, wherewith Professors Wise and Donaldson intend to attempt the passage of the Atlantic, starting from New York about the 20th of August next.

The only chance for a successful issue of this hazardous voyage, almost the only chance, indeed, for life which the daring aeronauts will possess, depends upon the flotant endurance of the aerial ship. To fortify the apparatus in this respect will be the paramount consideration of the navigators. Doubtless they would be glad to elongate the balloon, provide propellers and steam power, and so continue the experiments in aerial navigation ably begun by De Lôme and others. But the necessities of the present occasion forbid.

The ordinary rotund form of balloon, although unsuited for mechanical propulsion is best adapted for strength as a gas holder, and this is the form that has been wisely chosen.

Professor Henry, writing to the *Graphic*, also to Professor Wise, fully endorses the views of the latter in respect to the existence of constant easterly currents above the earth, and expresses the belief that, if the balloon can be kept afloat long enough, she may be wafted over the ocean to Europe. But he does not recommend the attempt, and, if it must be undertaken, wishes that some other person, in whom he had less personal regard than Professor Wise, were about to make the trial. He thinks that, as preliminary to this ocean voyage, Professor Wise ought to make an overland flight from the Pacific to the Atlantic, a distance nearly equal to the width of the Atlantic ocean.

To this Professor Wise replies that the easterly currents will be found steadier and safer over the ocean than above the land; and he prefers to take the risks of dropping into the sea rather than the chances of bumping against the cliffs of the Rocky Mountains.

In view of the Professor's experiences on his great voyage from Missouri to New York, in 1859, described in our last number, we think his conclusion is correct. He expects to be able to keep afloat in the air for at least ten days, while only three days will be actually required for the great "waft." To us, the probabilities of his success appear to be little better than those of an individual who, in an open boat, without sail or oars, should attempt to float across the Atlantic upon the surface of the Gulf Stream.

## A NEW SUBSTITUTE FOR RUBBER.

Daniel M. Lamb, of Strathroy, Canada, is the author of a method of producing gum from the milkweed plant, or other plants of the asclepia family, and flax and other seeds, which consists by macerating and fermenting the substances and then by evaporation reducing the resulting liquid to a thick gummy mass. The gum thus obtained may be cheaply produced, and is alleged to have many of the valuable qualities of rubber. It is insoluble in water, may be vulcanized with sulphur, etc. The price of pure rubber is now very high, and the discovery of an economical substitute is a matter of the greatest importance in the arts.

J. H. F. reports the discovery of a fossil corn shuck in Missouri. It was found 30 feet below the surface, imbedded in clay.

## SCIENTIFIC AND PRACTICAL INFORMATION.

### OXYMALEIC ACID.

M. Bourgoin gives the above name to a new organic acid which he states differs from maleic acid by 2 equivalents of oxygen, and from malic acid by 2 equivalents of hydrogen. Thus: Maleic acid $= C^8H^4O^8$, oxymaleic acid $= C^8H^4O^{10}$, malic acid $= C^8H^6O^{10}$. The new substance is solid, white, and of an odor similar to that of malic acid. It is very soluble in water, which it abandons on evaporation, under the form of very delicate, long, penniform crystals It is equally soluble in alcohol and in ether, separating itself from the latter vehicle in the shape of elongated crystals grouped in stars.

### NEW QUARRIES OF LITHOGRAPHIC STONE.

New quarries of lithographic stone have quite recently been found in Italy near the French frontier, and on the coast of the Gulf of Genoa; from these it is stated that an excellent quality of lithographic stone has been obtained. This discovery is of great importance, as of late years the supply of this stone, which has been almost exclusively, for European use, obtained from Germany, has been gradually diminishing, in proportion as the beds in that country were depleted.

### MEDICATED CRACKERS.

M. Limousin, a Prussian apothecary, encloses powders, such as quinine, aloes, rhubarb, and other drugs disagreeable to swallow, in crackers. The cracker is split and a matrix made within, in which the powder, carefully measured, is placed. The two parts of the envelope, which is quite small, are then closed together and secured. When taken, it is soaked in water for a moment until softened, then gulped down whole.

### STILL ANOTHER NEW ANILINE RED.

By allowing a few drops of chloride of sulphur to act upon 30 grammes of aniline, the mixture being continually stirred, Hamel has produced a new red dyestuff, which, in 10 minutes, became solid. This body dissolves in acetic acid with a red color, and on evaporating this solution to dryness, a black, glistening mass is obtained. Like most aniline dyes, it dissolves in alcohol, ether, and acetic acid. The study of this interesting compound has not yet been pursued far enough to ascertain its composition, nor can we yet prophesy its future.

### STEEL BOILERS.

The steamboat Mary Powell, running daily on the North river, between this city and Rondout, has recently been fitted with steel boilers. We append the dimensions and weights, which may be interesting to our readers. There are two boilers, of the form known as flue and return tubular. Each boiler has 10 flues of different diameters, 9, 15, and 16 inches, and 80 tubes of $4\frac{1}{2}$ inches outside diameter. Each boiler is 11 feet front, 25 feet long, and the diameter of shell is 10 feet. The sheets of the boiler are of steel, made by Parks Brothers, of Pittsburgh, and having a tensile strength of 70,000 pounds per square inch. The sheets are $\frac{5}{16}$ of an inch thick. Each boiler has two furnaces, each 8 feet in length and $4\frac{1}{2}$ feet wide. Blowers were used with the former boilers, to promote the draft; but a novel form of steam jet is at present employed, which seems to work very satisfactorily. The grate bars are cylindrical in form on top, and are provided with mechanism so that the fire can be shaken down when it is dull, somewhat after the manner of a grate in an ordinary stove. The boilers weigh 28 tuns each, the weight of the two being 7 tuns less than that of the old boilers. The consumption of coal per round trip is about 24 tuns. The diameter of the steam cylinder is 62 inches, and the stroke is 12 feet. The engine makes 23 revolutions per minute, the steam pressure being between 35 and 36 pounds.

## The Auroral Phenomenon of June 26.

The brilliant aurora borealis of the evening of Thursday, June 26, was accompanied by the appearance of a series of bars of light moving in rapid succession towards the north and disappearing, other bars coming on at the southern end of the series. Mr. G. Meyer, of Richmond, Mich., Rev. A. S. Talcott, of Garretsville, Ohio, Mr. H. P. Cobb, of Northville, Mich., and Mr. J. D. Beck, of Liberty, Pa., have reported the singular phenomenon to us, it being visible at the respective localities under slightly various forms.

## A New Steam Organ.

Thomas Winans, of Baltimore, the well known railway contractor, machinist, etc., is building, for his private music hall in the above city, a gigantic organ. It is to be worked by steam power. It will have twenty-five bass pipes each two feet square and thirty two feet long. It is to be finished within a year, and it is expected that it will be a roarer. Compared with it, the great organ of Boston will dwindle into insignificance.

M. KRUPP has just insured his steel factory at Essen, in twelve German companies, to the amount of $5,697,912. This sum includes the value set upon only the portions of the establishment liable to destruction by fire, and not that of the steam foundery, railroads, telegraph lines, canal system, special shops, and metal stock.

PHINEAS ALLEN, JR., for many years editor of the Pittsfield (Mass.) *Sun*, died in that town on July 4. The *Sun* was founded by and preserved in the Allen family for a period of 72 years, having been established in 1800.

THE extensive collections and preparation of mosses, made by the late William S. Sullivant, were bequeathed to Harvard University.

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## THE GARDNER GOVERNOR.

The invention illustrated in the annexed engravings is a new steam governor, which combines in its construction several points of advantage and merit. Among these may be noted a stop motion, by which the valve is closed down on its working seat when the governor belt breaks, instead of closing against another seat by the falling of the balls; a valve seat of hardened steel, or other durable metal, secured in a novel manner, and a facing of the valve with the same material, together with its mode of application; and, lastly, a hollow clamping or fastening stem for securing the valve seat, arranged to receive a guide stem for the lower end of the valve.

The illustrations are perspective, Fig. 1, and sectional, Fig. 2, views of the device. A is the hollow balanced valve contained in the chamber as shown. B is the inlet pipe, and C the conduit to the engine; D is the valve rod communicating with the weighted lever, E, Fig. 1, which serves to open the valve. The latter is closed by the rod, F. The fulcrum of the lever, E, consists of a tubular piece, G, fitted on a cylindrical rod secured to the plate, H, so that the tube can fall when required to do so, and will be regulated by the air cushion formed in its interior. In order to hold this fulcrum up in the required working position to cause the balls to regulate the valve, the frame is arranged so that it can turn on the plate, H, by a socket in its lower end, I, fitting over a stud on said plate. On the frame is an arm, J, which holds the fulcrum up by pressing under a flange or shoulder formed upon the tubular piece, G, Fig. 1. This arm is constantly borne in the direction to maintain the cylinder in such elevated position by the strain of the belt on the driving wheel, K, the belt being purposely so arranged.

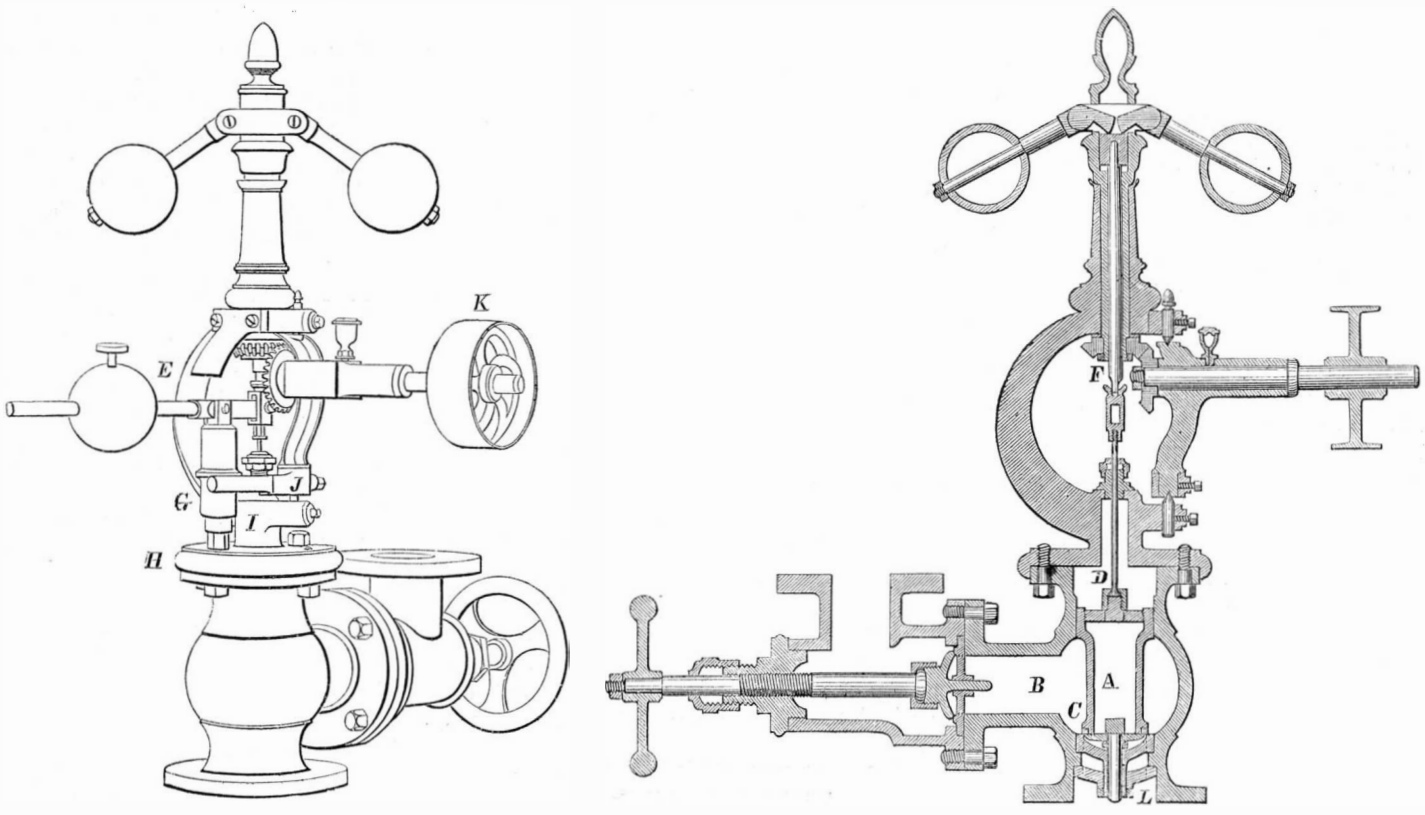


FIG. 2.

The shoulder on the tube, G, is beveled, and the arm, J, is rounded so that the gravity of the weighted lever will constantly cause the latter to swing back and let the lever fall, closing the valve, when the frame is relieved of the strain of the driving belt by its breaking or running off the pulleys. The arm may be reversed on its application to the stand of the governor frame, so that the belt may be applied from either of two opposite directions.

The valve seat is made of hardened steel or American Sterling metal, in order to resist the cutting and wearing tendency of the steam. It is secured in place without the use of screw threads by seating it in a rabbet in the casting, and clamping it therein by the spider, L, fitted in a reverse rabbet in the steam tube below. A stem passes down through the spider and is fastened by a nut at its lower end. The valve is re-enforced by a ring face of metal similar to the above, held by the clamp shown, which is screwed up by a nut on the stem, M, which is fitted in the hollow stem of the valve seat to guide the lower end of the valve. The ring may be reversed, after being worn out on one side, and a new face presented.

It is claimed that, by having the valve close for stopping the engine on the same seat with which it acts to regulate the quantity of steam, not only is the cost, of the extra seat commonly used, saved, but the opening of the valve wider before closing (together with the long movement usually made, causing the racing of the engine before its motion is arrested) is avoided. The trouble and delay due to the balls falling to the stop plane, and thus unnecessarily stopping the engine when a heavy load is thrown on with low steam, are also, it is stated, prevented by raising the valve by the weighted lever.

Patented through the Scientific American Patent Agency, May 20, 1873. For further information address the inventor and manufacturer, Robert W. Gardner, 424 Maine street Quincy, Ill.

### New Ozone Generator.

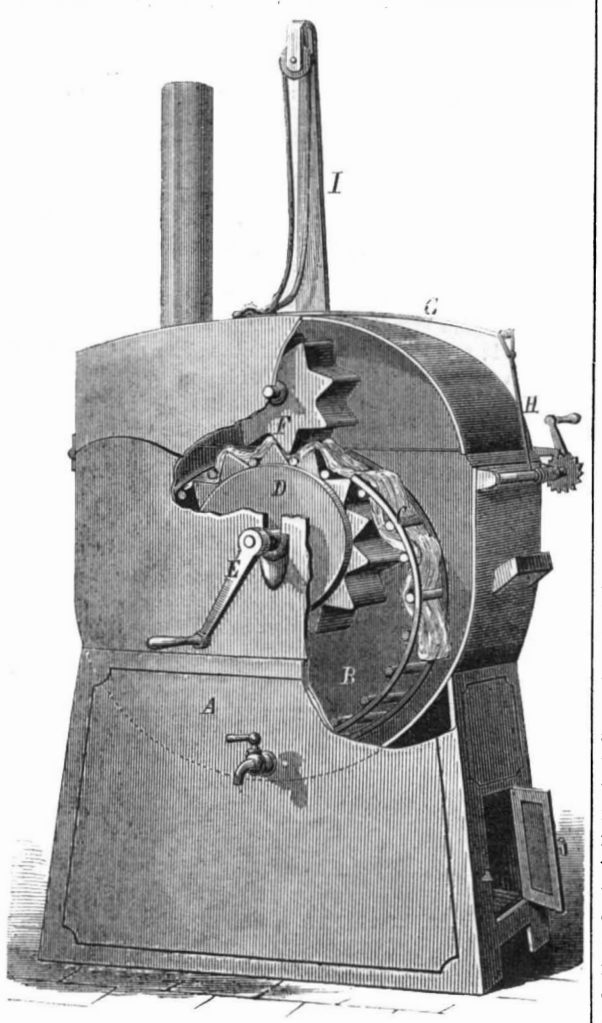
Siemens' tube consists of a piece of glass tube, with an annular coating of tinfoil on the exterior; in the interior is a carefully turned brass box, slightly smaller than the glass tube, and tinned to protect it from the action of the ozone. Through this box, a current of ice-cold water can be passed, so as to prevent the heating of the apparatus, the oxygen or air passing through the annular space between the box and the glass tube, which is fitted with caps and tubes for that purpose. The brass box and tinfoil coating are connected with the induction coil in the usual way. This apparatus yields large quantities of ozone with great ease, and appears to be more powerful than either of the other forms with the same battery power. Paraffin should be used for the joints, because, as pointed out by Sir Benjamin Brodie, that hydrocarbon is unattacked by ozone.

### Nose Bags for Horses.

In New York city and other busy places, it is common to supply horses with their necessary noon luncheon of oats by means of a canvas bag, made like a bucket and hung, from behind the animal's ears, over the nose. To secure a mouthful, the pony is obliged to give the bag an upward toss, which fills his mouth but, at the same time, throws out and wastes a portion of the feed. The aggregate waste of oats in this city alone, from the common nose bags, is estimated at fifty thousand dollars a year. A variety of devices have been invented to prevent this loss, one of the latest being that by H. D. McGovern, of Brooklyn, N. Y., who puts an additional bottom within the bag, on which the oats are placed. Under this bottom is a spiral spring. The weight of the oats compresses the spring, which expands as fast as the oats are eaten, thus keeping the supply always at the same level within the bags. The principle is the same as the spring candle holders for coaches and cars.

## IMPROVED WASHING MACHINE.

This invention is another recently patented apparatus for washing clothes, which may be used either with or without




a furnace for heating the water. The clothes may be boiled, washed, and afterwards wrung out in the same receptacle.

The furnace or fire box is shown in our illustration under the washing vessel, A. The latter is circular at its lower portion, and is provided with a suitable cover. Within it is a loose open cylinder, B, which is formed by connecting two rims with transverse rods, C. B is a corrugated wheel revolved by the crank, E. F is another and similar wheel journaled in the cover, the corrugations of which correspond and engage with those of the wheel, D, from which it receives motion. The cylinder, B, is larger in diameter than the wheel, D, by which, it will be seen, it is revolved, and also broader, so that there is space for the length of the teeth of the wheels between the rims. It is supported on the bottom of the vessel by rollers, to prevent undue friction.

In this cylinder, the clothes to be washed are placed and secured by the rods, C. Thus contained, the garments are carried around between the corrugated wheels, and at every revolution are dipped into the water in the vessel, A. As they pass between the wheels, any required amount of pressure can be applied by means of the spring, G, attached to the cover. A cord, H, is attached to the end of the spring, and is secured to the ratchet wheel crank shaft, as shown.

The vessel, A, is made of metal, so that, if necessary, the water may be kept at the boiling point and even a pressure of steam may be obtained, thus quickly cleansing the clothes. Wringing is effected by turning the crank back and forth so that the articles are squeezed between the wheels and not allowed to dip into the water.

I is a stand attached to the side of the machine, which is provided with a pulley and hooks for raising the wheel and cylinder from the vessel, slots being made in the sides of the latter, which allow the journals of the wheel to be raised clear therefrom, so that the receptacle may be used as an ordinary wash tub or boiler. The faucet shown serves to draw off the water, and the pipe to carry off the smoke.

Patented by Mr. Alfred L. D. Moore, of La Grange, Fayette county, Texas, who may be addressed for further particulars.

## THE TUNNICLIFFE FIRE ALARM.

One of the simplest and, to all appearances, most effective devices for giving timely alarm, in case of fire breaking out in a building, is the ingenious little invention the name of which forms the heading of this article. It is nothing more than a cylindrical barrel some three inches long by an inch and a half in diameter, which, by a screw attached midway along its length, may be readily secured to the ceiling or any part of the room desired. An engraving of the article may be seen on the back page of this number. It is made of malleable iron, with a smooth bore, and contains, when ready for use, a small charge of powder, to which is attached an inch of fuse. This fuse is formed of a chemical mixture that will ignite whenever the surrounding atmosphere is heated to 200° Fah.; that is to say, it is kindled by merely heated air, and at a temperature less than that of boiling water. In case of fire, the heat, which ascends at once to the ceiling, quickly ignites the fuse, and causes the required explosion to take place before the flames can get beyond a point at which they may be quenched by a pail of water.

The discharge of one of these protective instruments makes a report as loud as that of an army musket loaded with a regulation cartridge, sufficiently loud to be heard all over an ordinary four story building. The alarms can be so arranged as to ring bells in any desired room in the building where placed, and have already been attached to wires connected with burglar alarms in both stores and residences.

We recently took occasion to examine the working of this alarm at the manufacturer's, 697 Broadway, this city, where the alarm may be seen in operation any day; and by testing the degree of heat with a thermometer, we found that the fuse exploded and fired the instrument as soon as the specified limit of temperature was attained. We were assured that neither charge nor priming deteriorates by age, and that the explosion was unattended with either danger or marring of the wall. Many officers of insurance companies have recommended the adoption of the device as a preventive against fire. From an inspection of its operation, we are inclined to consider the invention as of considerable utility and merit. Its employment in the localities where many of the greatest conflagrations have originated would doubtless have been the means of timely warning and thus have prevented the vast losses which ensued.

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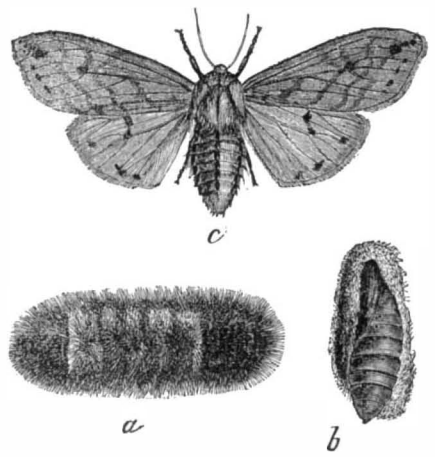
From the Fourth Annual Report of Charles V. Riley, State Entomologist of Missouri.]

### THE ISABELLA TIGER MOTH.

The larva of this insect, *a*, is very common with us, and is familiarly known as the hedgehog caterpillar. It is thickly covered with stiff black hairs on each end and with reddish hairs on the middle of the body. These hairs are pretty evenly and closely shorn so as to give the animal a velvety look; and as they have a certain elasticity, and the caterpillar curls up at the slightest touch, it generally manages to slip away when taken into the hand.

It feeds on plantain, clover, dandelion, grasses, and a variety of other plants, and after passing the winter in some sheltered spot, rolled up like a hedgehog, it comes out

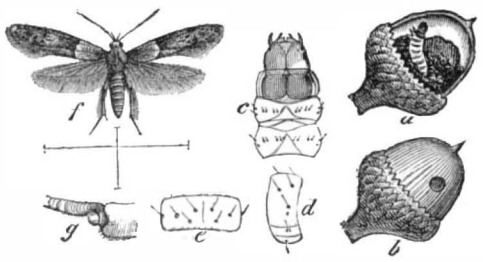



The Isabella Tiger Moth—*Arctia Isabella*, Smith.—(*Lepidoptera, Arctiadæ.*)

in the spring to feed upon the first herbaceous vegetation, and finally spins its cocoon (*b* represents one cut open, giving a view of the chrysalis) and goes through its transformations. The cocoon is composed principally of the caterpillar's hairs (which are likewise barbed) interwoven with coarse silk. The chrysalis is brown with tufts of very short golden bristles, indicating the positions of the larval warts, and with a tuft of barbs at the extremity. The moth is of a dull orange color, with the front wings variegated with dusky, and spotted with black, and the hind wings somewhat lighter and also with black spots.

### THE ACORN MOTH.

The mast, which is so valuable to the swine breeder in the oak land sections of Missouri, is often very seriously affected and greatly diminished in quantity by the workings of the larva or grub of a species of long snouted nut weevil (*balaninus rectus*, Say.) The female, with her long bill, pierces a hole in the young acorn, and deposits therein an egg which gives birth to a legless arched grub with a brown head. This grub devours during the summer the contents of the acorn, and in the autumn drops, with the rifled fruit, to the ground, where it soon gnaws its way out through a circular hole and buries itself for the winter. It becomes a pupa in the spring, and eventually issues as a beetle.




The Acorn Moth.—*Holcocera glandulella*, Riley.—(*Lepidoptera, Tineidæ.*)

After the original depredator has vacated its tenement, a little guest moth comes along and drops an egg into the already ruined acorn. The worm hatching from this egg grows fat upon the crumbs left by the former occupant, rioting amid the refuse and securing itself against intruders by closing, with a strong covering of silk, the hole which its predecessor had made in egress. In the winter time, or in spring or early summer, the farmer, who notices three fourths of the acorns under his trees infested, as they have been for the past two years, by this worm, is very apt to consider it the true culprit, whereas it is rarely if ever found in acorns that have not first been ruined by the weevil above mentioned, or injured by some other insect, or in some other way.

This after comer is of a yellowish or grayish white color, often with dark marks on the back, a light brown head, and a horny piece of the same color on the first and last joints, and small hair-emitting dusky points over the body, *c d e*. It is, withal, easily distinguished from the weevil larva by its full complement of six true and ten false legs. It changes to the chrysalis within its borrowed domicile, and the chrysalis gives forth the moth by first pushing partly through the silken door.

The moth, *f*, is ash gray in color, and characterized chiefly by two distinct spots near the middle of the front wings and a transverse pale stripe, well relieved behind, across their basal third. The male differs from the female by the basal joint of his antennæ being much flattened and articulating with the stalk by means of a nodule, *g*. The moths issue all along from the end of April till September. They vary much in size and conspicuity of design.

JOHN E. LAUER, of New York city, produces the acid phosphates for yeast powders by treating bone black first with sulphuric acid and afterwards with muriatic acid.

## Correspondence.

[For the Scientific American.]

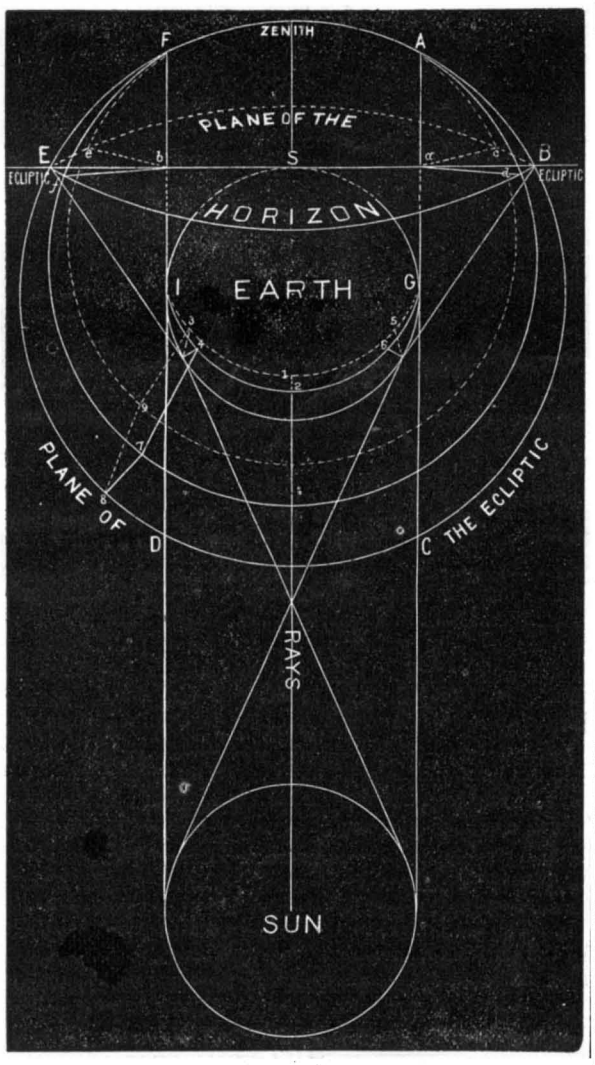
### Explanation of the Cause of the Zodiacal Light.

What is known as the zodiacal light is an optical phenomenon caused by the reflection of the rays of the sun from the earth, upon the atmosphere and thence to the spectator.

For the purpose of illustration I have taken the case of the "double light" (a pyramid in the east and one in the west at the same time), as a knowledge of the principle involved in the formation of the double light includes that of the single pyramid.

The most favorable condition under which the zodiacal light can be seen is when the spectator's position is in the plane of the ecliptic, and this is probably the only position from which the double light can be seen at all, the plane of the ecliptic being then perpendicular to the spectator's horizon.

The figure annexed is a representation in perspective of the plane of the horizon (the spectator's station being at S, the earth), showing the lune, G 1 I 2, from which the rays are reflected, as regards the spectator; the atmosphere, A B C D E F, showing the portion illuminated by reflection from the lune, 4, 7, 8, 9, 3, being a section in the plane of the spectator and the sun. The portion of the illuminated atmosphere which alone will be visible to the spectator, at S, will be those parts illuminated by the reflection from the portions of the lune included in the spherical triangles, 5 G 6 and 3 I 4, all the rest being below the plane of his horizon; the reflected rays, 5 *c*, 6 *d*, 3 *e* and 4 *f*, are omitted to avoid confusion in the lines. The visible parts will, therefore, appear to him in the form of the two pyramids, A *a d* B *c*, and F *b f* E *e*, their bases, *a d* B *c* and *b f* E *e*, resting on the horizon, and their apices being limited by the thickness of the atmosphere, *a* A and *b* F. It is evident, therefore: (1) That any deviation of the position of the spectator from the plane of the ecliptic would be attended by a simultaneous change in




the form and position of the pyramids, in consequence of the change in the form of the lune. (2) The double light could only be seen at, or about, midnight, as at that time the spectator is directly on the opposite side of the earth from the sun, and the lune, therefore, is perfect. (3) The intensity of the light would vary according to the nature of the portion of the surface of the earth from which the rays were reflected at the time, as land, water, etc. (4) The brightest part of the pyramids would be the center of the base, on account of the greater thickness, as regards the spectator at S, of the illuminated portion of the atmosphere through that part, that is, along the lines *a* B and *b* E. (5) On the same principle, the moon should also give a zodiacal light. The most favorable time would be when the spectator's position was in the plane of the moon's orbit, a short time before her rising or after her setting, and about the time of the full moon. The moon, however, could not give the double light, because, she being much smaller than the earth, the cusps of the lune would not embrace the whole of the semi-circumference of the earth, and therefore the reflection could not reach that part of the atmosphere above the plane of the spectator's horizon.

The pulsations noticed by some observers are, without doubt, the effect of refraction, either in the body of the atmosphere, or perhaps caused by the irregular motion of its surface (atmospheric waves).

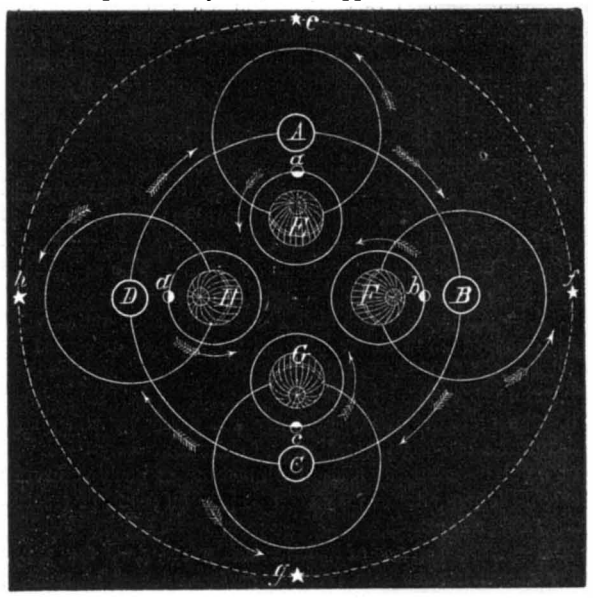
Query: May not the tails of comets be accounted for upon similar principles? In the case of some comets, the enormous length and rapid changes of these supposed appendages appear to indicate the earth's atmosphere as the medium of the second reflection. The question can only be decided by observation. T. R. L.

Mount Airy, Philadelphia, Pa.

### Retrogressive Motion of the Sun.

*To the Editor of the Scientific American:*

In the hopes that my friend and opponent, C. H. B., would




have favored me with his full name, or at least would have replied to me privately, I withheld sending you my diagram showing how precession of the stars is produced by the retrograde motion of the sun. But as he has not complied with my wish, neither opposed me, so far as I know, publicly, and as other astronomers have expressed much surprise at my views and doubts as to their truthfulness (one actually predicts my defeat in case C. H. B. replies): I now present my diagram; and if it fails in one single iota to come up to all the demands of Nature, so far as precession of the stars and recession of the equinoxes is concerned, I will be more than obliged to C. H. B., friend Swift, or any one else to point me to that defect. Instead of a defeat on my part, I am sure of success, and that, no doubt, C. H. B. is beginning to see, or else I am far mistaken; and so will all competent judges, when they study the subject as it deserves.

A B C D in the figure represent the sun in four points of his retrogressive orbit, 90° apart from each other; E F G H represent the earth invariably at her summer solstice, as she is carried backward, as it were, in her orbit, by virtue of solar motion; and *a b c d* represent the moon at four different points of her orbit, also 90° apart from each other, where she will eclipse the sun; *e f g h* represent stars in the ecliptic, or in a circle surrounding the pole of the ecliptic, also 90° apart from each other. The dotted circle represents the ecliptic, the larger ring the orbit of the sun, the lesser rings the orbit of the earth, and the smallest ones the orbit of the moon, and the arrows the direction of movement, respectively, of sun, earth, and moon.

From this it will be seen at once that as A (the sun) retrogrades toward B, the star, *e*, together with all the others, will, as it were, advance eastward; and their rate of apparent motion will be in proportion to that of the sun's real motion. For instance, when the sun reaches B, he will have completed one quarter of his orbit, or 90° of it, and so the stars will have advanced 90°. To move from A to B will take the sun about 6,467 years, and the same time to move from B to C; and so on all around, completing his orbit in 25,868 years. For every ninety degrees the sun retrogrades, ninety degrees is cut off the earth's orbit, as it were. In other words, for every quarter of an orbit the sun completes, the earth comes to her equinoxes one quarter of a year sooner than she would do if the sun were standing still, or if he were pursuing a straight forward course. And so, for every full orbit he makes, the year of the earth is completed 365¼ days sooner than it would have been had the sun been fixed in space. Thus we have 25,868 solar years in 25,867 sidereal years. The truth stands then that, as solar time is prolonged to the amount of one day (less 20 minutes and near 23 seconds) by the motion of the earth direct around the sun every year, so solar time is shortened to the amount of one day in 25,868 days and to one year in the same number of years, by the sun's retrogressive movement in space.

It will now be seen that the so called retrograde "wabble" of the earth is not a gyration, as Newton supposed and as his followers still imagine, but that it is simply a change in her parallelity of polar position, gradually and surely brought about by the retrograde motion of the sun. Precession of the stars and recession of the equinoxes is not therefore peculiar to the earth; but is alike common to and performed in the same length of time by all the planets of our system.

Will C. H. B. or any other interested astronomer be kind enough to examine this theory fairly and minutely, and then answer "yea," or "nay" to it, through the SCIENTIFC AMERICAN, and they will very much oblige its humble author? JOHN HEPBURN.

Gloucester, N. J.

### Location of the Million Dollar Telescope.

*To the Editor of the Scientific American:*

Mr. Alvan Clark, in a letter to *Appleton's Journal*, calls attention to the main difficulty attending the use of great

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telescopes, namely, the "everlasting commingling of warmer and cooler portions of atmosphere between the object glass and object."

This atmospheric disturbance may be very much lessened by selecting a proper place for the observatory.

Professor Young finds the air at Sherman station, U. P. R. R., to be much clearer than at the Eastern seaboard, and those who have visited the parks of Colorado will remember the great brilliancy of their star light.

It is only necessary to immolate, in the interest of science, a sufficient number either of gentlemen of the Signal Service or volunteers, each on his mountain top, from Pike's Peak to the Himalayas, to find localities where Professor Tyndall himself could not object to the want of optical purity in the atmosphere.

The telescope being once established on its distant peak among the upper trade wind currents, and adjusted for pho tography, we may all look at once, by using ordinary and well known processes. Each photographic picture, as taken, is to be sent all over the world by copying telegraph, and published next morning in the newspapers. The operations are as follow :

1. A negative is taken, either with instantaneous or very short exposure, and either photo-lithographed, or copied by a gelatin relief print.

2. The print is electrotyped or pressed.

3. The electrotype is gradually cut away by the sharp pointer of a copying telegraph, and simultaneously engraved on a steel cylinder, by a similar machine at each receiving station. This cylinder may then be printed from, or treated as any other engraving.

The great accuracy of workmanship required for these relay engraving engines may be readily attained by milling machines with shaped diamond cutters. S. H. M., JR.

### The Kromschroder Gas.

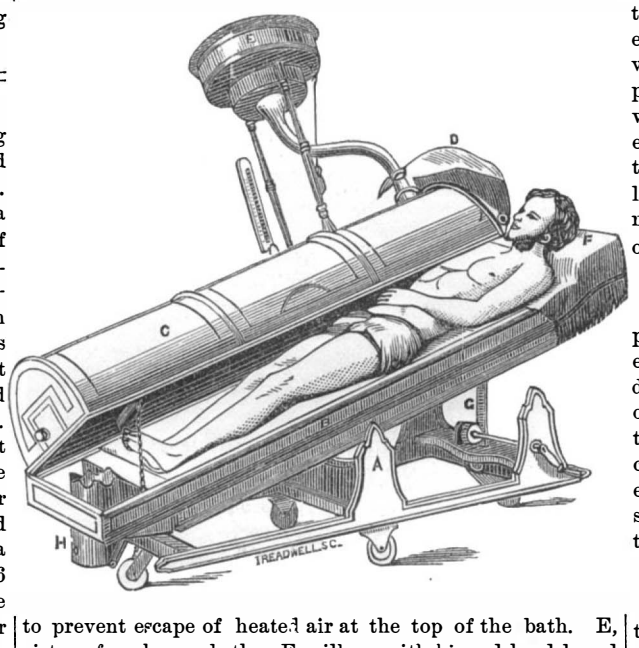
Several new methods of producing gas for illuminating purposes have of late been brought before the public, and among others is the process invented by Mr. Kromschröder. This consists in simply passing air through the vapor of a light hydrocarbon, the two combining and forming a gas of high illuminating power. The process has been in operation for about three months at Great Marlow, in Bucking-hamshire, where we had the opportunity of examining it on Saturday last. The town of Great Marlow, however, has only been lighted regularly with the new gas for the past three weeks, its previous use having been intermittent and experimental, the ordinary coal gas having also been used. So successful, however, were these experimental trials that the Kromschröder gas is now regularly consumed, and the manufacture of coal gas is discontinued. The apparatus for the production of the gas is of a very simple character, and is erected in the gas works of the town. It consists of a sheet iron chamber 5 feet long, 4 feet wide, and 3 feet 6 inches high, the lower portion being 2 feet wider than the upper part for a hight of about 12 inches. In the upper chamber is placed a valve arrangement driven by clockwork and by which atmospheric air is forced into the lower or enlarged portion. Here it is made to pass through a mass of open fiberous material, the lower part of which is kept immersed in a liquid hydrocarbon. The air in its passage combines with the vapor of the hydrocarbon in the proportion of 70 parts of air to 30 of the vapor. In this condition the gas—for such it has now become—is conducted from the mingling chamber by a pipe into a receiver, capable of containing 100 cubic feet of the gas. As soon as this receiver is filled, its contents are discharged into the gas holder which was formerly used for the storage of coal gas, and which has a capacity of 6,000 feet. The reason for having the intermediate receiver is that the incorporating apparatus, although of ample power for producing the required quantity of gas, does not give sufficient pressure to lift the large holder, which is 30 feet in diameter. The time required to fill the large holder, or, in other words, to manufacture 6,000 feet of gas, is five hours. From the large holder the gas is supplied direct to the town, there being no purifiers or other apparatus required. The four main requirements in a gas for illuminating purposes are quality, cheapness, permanency, and capability of travel. As regards the first point, it was shown by photometric experiments that, with a burner consuming $3\frac{1}{2}$ feet per hour, a light equal to twenty candle gas was obtained, which is charged to consumers at 3s. 3d. per thousand feet, and this solves the second point. The permanency of this gas has been proved by allowing it to remain for three weeks in a holder subjected to the various temperatures, when a loss of 33 per cent was found to have been sustained. Lastly, it has been made to travel through $4\frac{1}{2}$ miles of pipes, and from its nature there is no doubt that it will travel any reasonable distance. The success of the gas is stated by its inventor to be due to the exact proportioning of the air and hydrocarbon vapor, a result he has only arrived at after several years of careful experimental research. Those proportions are, as already observed, 70 parts air to 30 of the vapor. To insure this result a hydrocarbon of constant specific gravity is used, that gravity being 6 70. Mr. William Bruff, C. E., is interesting himself in this invention, and it is from his experiments that the foregoing conclusions are deduced. The photometric experiments were witnessed and checked by ourselves. In the evening a drive round the town enabled a very satisfactory opinion to be formed of the gas as an illuminator, which opinion was strengthened by the use of the same gas at the hotel where the party of engineers and scientific gentlemen who had been inspecting the gas dined. Mr. Kromschröder, who explained the process of manufacture, observed that the gas is designed not so much to supersede coal gas in large towns as to afford a means of cheap gas light where coal gas could not be had. So far as the experiments go, the Kromschröder gas would seem well adapted to this purpose, and we wish its inventor success.—*Engineering.*

### NEW TURKISH BATH.

The Turkish bath, as commonly practiced, consists in placing the patient in an apartment heated by stove or pipes to a temperature of 110° to 120°; in a short time, as soon as the pores begin to open, the patient passes into a still hotter chamber, where there is a temperature of from 150° to 210°. Here he remains until profuse perspiration is induced, and then, if he desires, enters a room heated still higher. He then passes into a wash room having a reduced temperature, is washed with warm water, then cooled with the spray bath; he then plunges into a swimming bath at the ordinary atmospheric temperature, which completes the ablutions.

The Turkish bath is a beautiful luxury and has but one discomfort, to wit, the highly heated atmosphere of the perspiring chambers. This is very oppressive to many persons; and to provide a portable bath as well as to overcome the difficulty just mentioned is the object of the present improvement, made public in the British *Medical Journal*:

A is the carriage upon which the bath rests, the wheels of which are so arranged that the whole apparatus can be turned completely round in a space little more than its own length. B, the frame and spring mattrasses fitted with centers to the carriage A, and forming the bottom of bath. C, enamelled metal cover, hinged to the frame B, forming chamber for heated air. D, waterproof and airtight apron




to prevent escape of heated air at the top of the bath. E, cistern for shower bath. F, pillow, with hinged head board to turn up when the bath is not in use. G, rack and pinion for raising or lowering the bath to the level of a bed, for use of an invalid. H, heating apparatus.

This invention is designed to supply to the public a portable Turkish bath in a complete and simple form. The advantages of the patent over the ordinary public Turkish bath are these: The heat can be raised in less than ten minutes to 180° Fah., and to the full temperature of 220° Fah. in fifteen minutes. The heat is obtained from gas, spirit, or other suitable means; it is under perfect control, and can be maintained at any degree, up to 220 Fah., that may be required. A shower bath is attached, by means of which a copious discharge of tepid or cold water can be obtained, suddenly or gradually, at the pleasure of the bather or attendant.

The head may, if required, be kept out of the bath in cool air. The bath offers in this respect one of the advantages of the sand bath, in which the entire body, with the exception of the head, is covered. It is probable that the therapeutic effects of the bath, with and without the exposure of the head to the heated air, may be very different.

### Heating Power of Different Fuels.

A practical method of determining the heating power of fuel has recently been given by E. Seidler in the *Zeitschrift für Zucker Industrie.* The object is attained by first drying some 100 lbs. of the fuel at 1,000°, and noting the loss in weight; then by burning a measured amount, 2,000 lbs. for instance, weighing the ashes and cinders, and, after allowing $\frac{1}{4}$ per cent for ashes carried off by the draft, calculating the amount of combustible in the fuel; for example, supposing the fuel was found to stand as follows: Water, 40·75 per cent; ashes and cinders, 17·0 per cent; ashes carried off by draft, ·25; total, 58·0 per cent, leaving 42 per cent of combustible in the fuel; 2 per cent may be subtracted from the percentage of ashes and cinders for the coal which falls between the bars of the grate. For peat, multiply the percentage of combustible thus formed by the factor 7, and deduct from that the percentage of water in the fuel, to arrive at the amount of water in pounds which will be evaporated by one pound of the fuel; for example, in the above case, $0{\cdot}42 \times 7 = 2{\cdot}94$, which $-0\ 4075 = 2{\cdot}5325$. A tun of such fuel then will evaporate $2000 \times 2{\cdot}5325 = 5065$ lbs. water at 0°, developing $5065 \times 640 = 3{,}241{,}600$ heat units. If the water used is run into the boiler at a higher temperature, 20° for example, the amount that can be evaporated by one tun is

$$\frac{3{,}241{,}600}{620} = 5228 \text{ lbs.}$$

### EN ROUTE TO THE GREAT EXPOSITION.—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 2.—Continued

LONDON, JUNE 10, 1873.

The day in Glasgow afforded time to visit the great shipbuilding establishment where Randolph and Elder did so much toward the introduction of the "compound" engine and of iron ships, and to see the University of Glasgow where James Watt worked as a repairer of instruments, and where he made himself a name more enviable than was ever won by the sword, and not less enduring.

#### GLASGOW UNIVERSITY

has just been driven from the old structure which has so great historical interest, and is just becoming reëstablished in a noble pile of buildings at the summit of a high hill at the extremity of a beautiful park, at the west end of the city, where its surroundings are quite in keeping with the architectural beauty of the edifice itself. The new university buildings will, when completed, have cost about one and a half millions of dollars. Something more than one half the sum was contributed by the public spirited citizens of Glasgow. The floor space amounts to about six acres. The buildings are as convenient in their interior arrangements as they are beautiful on the exterior, and the visitor is compelled to admire alike the intelligence which has sustained and encouraged the growth of this noble institution and that which conducts its academic course. (We published an engraving of this structure on page 179 of our volume XXVII.)

The old model of the Newcomen steam engine, which, when sent to Watt for repair, first attracted his attention to the defects of then existing machines for applying the power of steam, and prompted him to make the intelligent investigations which led him to its improvement, is carefully preserved here; and we stood by it a long time, examining with interest its every part, and enjoying, with rarely equaled pleasure, the many historical associations which it brought to mind. We were pleased to learn that nothing, among the large and interesting collections of the University, attracts more attention from visitors than this battered and discolored old model.

#### THE LATE PROFESSOR RANKINE.

The University has met with a serious loss during the past year in the death of Professor Rankine, who will be ever remembered as one who, at the time of his death, had done more than had ever been done before in the application of science to practical investigations, and, particularly, as the first to give practical shape to the known scientific principles involved in the construction of steam and other heat engines, and in naval architecture. The city of Glasgow should build a monument to his memory, nobler than any of those which now adorn St. George's Square.

#### SHIPBUILDING ON THE CLYDE.

In our journey to and from Govan—the village just below the city, in which the shipbuilding establishment of Elder & Co. is situated—we counted some fifty iron steamers, in all stages of construction, and probably one third more might be laid down in the yards. Business has been severely checked by the recent rise in price of stock and labor, in consequence of strikes here and in the iron and coal producing districts. Very little new work is projected, and the consequences of the movement seem likely to be a serious loss of trade and much consequent suffering among the working people who are daily being thrown out of work. Iron which, a year ago, was worth fifty or fifty-five shillings a tun to-day costs a hundred, and all other expenses have risen greatly, and sometimes proportionally. Contracts are therefore made elsewhere, and Glasgow workmen must suffer at home, or must emigrate to some busier spot, unless a change for the better takes place here.

Elder & Co. now employ some 2,500 men, and have facilities for employing 6,000 or more. They are building seven or eight ships, and have room to lay down a half dozen more. Their new engine shop is one of the finest in the world, and is splendidly arranged for their work. Traveling cranes, radial drills, steam riveting machines, and very large planing and slotting machines are well placed, and small tools in considerable variety, but not equally creditable in design and construction, are placed out of the way on lofts, above the larger tools.

This firm began many years ago the construction of the compound engine, and were among the very first to make it a specialty. They were a long time pushing it into use, but the introduction of surface condensation in sea going vessels, and the gradual rise of steam pressure which succeeded, enabled them to exhibit more and more convincingly the economical superiority of that plan, and they are now reaping the harvest which they fully deserve. They do more work by far than any other firm on the Clyde.

A large amount of capital is invested in Glasgow in other branches of industry, one of the most important being the manufacture of chemicals. Her manufactures and her commerce have, together, produced rapid growth in wealth and population. The city now contains nearly 600,000 people.

> "See what a change trade's golden wand can do!
> As if by magic, make a village spring
> To all the glories of a capital."

We were able to spend a few hours in Edinburgh, and there visited the old castle, the history of which is so familiar to every school boy. Thence we came to London by night train. It was by no means a comfortable ride, for the managers of the road have not yet exhibited a very strong desire to make their patrons comfortable, and have not introduced sleeping cars. R. H. T.

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## ON GIRDERS AND FLOOR BEAMS.---THE EFFECT OF CROSS-BRIDGING.

MASON CITY, IOWA. June 5, 1873.

MESSRS. MUNN & CO., New York city:

*Gentlemen:*—A building having joists 28 feet long, 2 inches x 12 inches, has a stringer 20 feet long, 6 inches x 8 inches, running crosswise and under the joists, supported at each end vertically. How much greater weight, if any, would it support at the center—weight being made to bear on two joists only—by having the stringer securely fastened to each joist, without weakening the joists or stringer? The joists are common pine; the stringer is of yellow pine. The joists are 16 inches apart.

There is a great difference of opinion; please give yours as fully as will explain the above. Very respectfully,

A. S. CHINES.

REMARKS BY THE EDITOR.—In the examination of this question, it is evident that if the "joists" or floor beams are so disconnected that when the load is applied it deflects only the two beams upon which the load rests, then attaching the "stringer" or girder to the other beams will increase the strength, and consequently the load upon the floor may be safely increased.

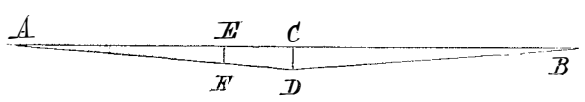
This will be apparent upon a consideration of the relation between the load and its resistance. The resistance to the downward movement of the load is that possessed by the timber. Timber has a limited power of resistance to deflection. The load it will carry is measured by the measure of this resistance.

Now the girder has a certain amount of resistance, and each of the floor beams has its resistance; and it is evident that, as the whole is greater than a part, so the girder assisted by all the beams will be stronger than if assisted by only two of them. The floor, therefore, will carry an increased load in consequence of attaching all the floor beams to the girder.

As to the amount of the increase in the load, that will now be considered.

Experiment has shown that within the limits of elasticity the deflection of a beam is directly in proportion to the weight laid upon it. For example: If 100 pounds deflect a beam one inch, 200 pounds will deflect it two inches, and so in like proportion for all weights and deflections.

Now, of the several beams attached to the girder, the service that each will render, in resisting the weight, will be in proportion to the distance it is deflected. The beams will all be deflected just as much as the girder is, but the amount of deflection which each will sustain will be according to its position upon the girder, the greatest deflection being at the middle of the girder, and thence each way to the ends, the deflection gradually diminishing to nothing at the ends. In deflecting the girder the upper surface becomes curved, and an ordinate to this curve, drawn at each beam, measures the deflection of that beam. But to avoid the intricacy involved in obtaining these ordinates, it will be sufficient for the present purpose to consider the top of the girder as not curved but declining from each end in straight lines to the point of greatest depression at the middle. Thus in Fig. 1, if ADB be the top line of the girder when deflected by the load at the mid-

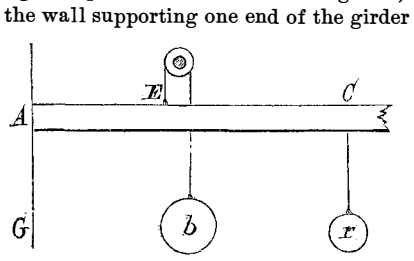



dle, then CD will be the deflection at the middle, and EF the deflection at E. AEF and ACD are similar triangles, therefore their corresponding lines are in proportion, thus, AC : CD : : AE : EF; or, putting for these several lines respectively the letters $l$, $a$, $m$, and $b$, then $l : a : : m : b$, from which $b=a\frac{m}{l}$. This expression gives the value of the line EF, drawn at any distance from A, and hence may be used to obtain the deflection of each beam located anywhere from A to C.

This gives the deflections, but inasmuch, as before stated, the weights are as the deflections, therefore $a$ and $b$ are in proportion as the weights which deflect the two beams at E and C; or when, by any scale, CD measures the weight which is required to produce the deflection, CD, in a beam crossing the girder at C, then will EF by the same scale, measure the weight required to produce the deflection, EF, in a similar beam crossing the girder at E; or $b=a\frac{m}{l}$, when $b$ equals the weight at E, and $a$, that at C.

By this formula, the resistance which each beam exerts may be ascertained. But this resistance is that which is exerted by each beam at its location; while the weight to be resisted is not at the beam, but at the middle of the girder. The resisting power, therefore, will have to act with leverage, and this leverage will now be considered:

Let AC, Fig. 2, represent one half of the girder, and AG the face of the wall supporting one end of the girder:




Let a weight, $b$, equal to the resistance exerted by a beam located at E, be suspended by a rope over a pulley, the other end of the rope being attached to the girder at E. The weight, $b$, may thus represent the resistance exerted by the beam located at E; and when there is an equilibrium between this weight and the weight, $r$, suspended from the middle of the girder, then $r$ will represent the weight at the middle of the girder which will be sustained by the resistance of the beam at E. To obtain the value of $r$, it may be observed that the weight, $b$, acts with the leverage, AE. Let $m$ represent this distance. The weight, $r$, acts with the leverage, AC, or half the girder, equal to $l$. Now, when there is an equilibrium, the product of one weight into its leverage equals the product of the other weight into its leverage, hence $bm=rl$, from which, $r=b\frac{m}{l}$.

Substituting, in this expression, for $b$, its value $a\frac{m}{l}$, as before found, then $r=a\frac{m}{l}.\frac{m}{l}=a\frac{m^2}{l^2}$.

In this expression, $r$ equals the weight, at the middle of the girder, which will be resisted by any one of the beams crossing the girder at the distance $m$ from A; and $a$ represents the weight which will be resisted by a beam located at the center of the girder. From this expression the resistance of each beam may be had. In order to gather the several resistances in one, let the beams as they cross the girder divide it into equal spaces, and let $c$ equal one of these spaces. Now the distance AE, Fig. 2, from the end of the girder to the location of one of the beams will contain a certain number of these spaces. Let $n$ equal this number; then $cn$ will equal $m$, the distance AE, and may be substituted for it, thus: $r=a\frac{m^2}{l^2}=a\frac{c^2n^2}{l^2}=n^2\frac{ac^2}{l^2}$.

In this expression, $a$, $c^2$ and $l^2$ are constants; that is, for any given case, they will not change, in the application of the formula to each beam. For convenience, let $t=\frac{ac^2}{l^2}$; then $rn=^2t$.

For the first beam from the end, $n=1$, for the second beam, $n=2$, for the third, 3, and so on to the middle of the girder.

Now, in this case, there are 14 beams crossing the girder. 7 on each end, or 6 besides the 2 nearest the middle which carry the load.

The several values of $n$, for these six beams, are 1, 2, 3, 4, 5, 6; and the several values of $n^2$ are 1, 4, 9, 16, 25, 36.

The sum of the resistances, therefore, of the six beams, is

$$R=1t+4t+9t+16t+25t+36t.$$
$$R=t(1+4+9+16+25+36).$$
$$R=91t.$$

The sum of the resistances of the other six beams being the same, therefore, for the twelve beams, $W=182t$, or, substituting for $t$ its value: $W=182\frac{ac^2}{l^2}$.

The value of $c$ for this case is 16 inches, $=1\frac{1}{3}$ feet, and $c^2=1\frac{7}{9}$. The value of $l$ is 10, and of $l^2$, 100.

The value of $a$ is to be obtained from* $a=\frac{Enbd^3}{l^2}$, in which $b$, $d$, and $l$ respectively stand for the breadth, depth and length of the beam; E is a constant, derived from experiment, and for white pine equals 1750; and $n$ is the rate of deflection per foot of the length of the beam.

If the rate of deflection in the girder, which is 20 feet long, be assumed at 0·04 of an inch per foot, then the rate of deflection of a beam at the middle of the girder will be 0·0286, the beam being 28 feet long; therefore n = 0·0286. The beam being 2 × 12, $b=2$, and $d=12$; also $l=28$. Therefore $a=\frac{Enbd^3}{l^2}=\frac{1750\times0{\cdot}0286\times2\times12^3}{28^2}=220{\cdot}63$.

Therefore $W=182\frac{ac^2}{l^2}=182\times\frac{220{\cdot}63\times1\frac{7}{9}}{100}=713{\cdot}86$.

This is the additional load at the center due to the assistance afforded by the 12 beams.

The resistance of the girder and that of the two beams may now be ascertained. For one of the two beams, the same formula will serve as for each of the others, thus, $r=a\frac{n^2c^2}{l^2}$. In this case $n=7$ and $n^2=49$, therefore $r=220{\cdot}63\frac{49\times1\frac{7}{9}}{100}=192{\cdot}19$. And $2\times192{\cdot}19=384{\cdot}38$ = the resistance afforded by the two beams. The formula $W=\frac{Enbd^3}{l^2}$ will give the resistance of the girder. The girder is of yellow or Georgia pine; for this wood, E = 2970. The value of $n$ is, as before assumed, 0·04, and $b=6$, $d=8$, and $l=20$. Therefore $W=\frac{2970\times0{\cdot}04\times6\times8^3}{20^2}=912{\cdot}38$.

The several results are as follow:

| | |
|---|---|
| The resistance of the girder | 912·38 |
| The resistance of the two beams | 384·38 |
| Girder and two beams | 1296·76 |
| The resistance of the 12 beams | 713·86 |
| Total resistance is | 2010·62 |

Or, in round numbers, the girder and two beams will sustain safely 1,300 pounds; but if aided by the other beams, as proposed, they will sustain 2,000 pounds. The addition is about 65 per cent. Stronger beams would make the percentage of increase higher.

The question discussed in this article is essentially that of the value, in a tier of beams, of what is known as "cross bridging;" for when beams are braced to each other by this device, they each help to sustain any concentrated weight.

SCREWS IN PLASTER WALLS.—W. A. A. of Hartford, Conn., states that screws are best inserted in plaster by making the hole large enough and driving in a wooden plug. It is better to split the plug and cut a groove in each half.

* *American House Carpenter*, page 206. (38.)

### The Patent Law Discussion.

A correspondent, E. A. B., of Georgia, writes as follows, in regard to the first question propounded by the Secretary of State (see page 7 of our current volume): "Is the protection of inventions by patents just and expedient, and, if so, on what grounds?"

"There are two theories on the subject, of which yours is one. I will say a few words about each in turn. 1. One is expediency, held by you. If, as you say, patents are a 'tyranny,' no expediency could make them other than a wrong. If we use the word expediency to signify the advancement of men, moral, then mental, then material, it never could be gained by violation of men's rights. Men have not 'equal rights;' they have merely an equal claim to justice or to defense of their rights. On the ground of expediency, men cannot be made to feel an obligation to sustain patent or other laws. It is sometimes said that, when regulations of expediency become the law of the land, it is thereby made a duty to obey them. But this goes on the supposition that the claim of a government does not depend on the justice of its laws, but the justice of its laws depends on its will. This makes all forcible revolutions, without exception, wrong; and its operation would have for ever prevented free government. Expediency does, however, help to determine all questions of human property.

2. The other theory puts patents, along with other property, on the ground of men's convictions of right. Men do, in a thousand ways, show that they have the conviction that what any person produces by his sole work is rightfully his property. But this principle alone will not serve as a basis for men's property, either in ideas or things material. Ideas are mere abstractions, and property does not consist in abstractions. Property is exclusive, and different men might have the same ideas. As to the material property of men, it cannot rest on the mere conviction that every person rightfully owns what he produces by his sole work. Since men cannot create, in the proper sense, it is clear they cannot by their sole work produce anything. They must have material and instruments, and a right to them. Thus neither theory alone is sufficient foundation for any right of property. But put the two together and they are worth something. The ownership is in the Creator of the world, and of course He could convey it to men. That laws recognizing and protecting ownership in men do advance men's interest, moral, mental, and material, in the order named, is a proof or sign that God designs to convey ownership. For, on any view of God, held by civilized people, He designs the progress, first moral, then mental, then material, of all who aim thus to advance; and this is best furthered by laws recognizing and protecting property. God designs that manufacturers should pay wages to the inventors for the mental labor of the latter, as well as to operatives for their manual labor, as He designs that the public shall pay the manufacturers for their goods. We know that God wills it because the legitimate interests of human beings are advanced by it, or, in other words, it is expedient in every sense.

Whenever we cannot get any work voluntarily done which the permanent interest of the public demands, without recognizing some right of property, it is a sign that right exists. It is very desirable to keep the popular discussion of this matter from getting on metaphysical grounds. If those who see that it is impossible to settle any question of property without using the argument from expediency would guard their language and call expediency merely a sign or token of existing right, not the origin of right, they would keep off metaphysical ground. It would also conduce to the same end if men would not talk of 'right of property in ideas,' but of the right of inventors and authors to wages.

The first subject of inquiry consists really of two vastly differing questions. That patent laws are expedient, I have assumed because I was discussing the right, and it was necessary to show its relation to expediency. But the existence of expediency is one of the points of inquiry."

### New Method for Boot and Shoe Heels.

John Blakey, of Leeds, England, has lately patented in this country a method or process of forming heels or heel lifts for boots and shoes, by first cutting, from waste scraps of leather, small pieces of appropriate size and shape; next, compacting and solidifying such pieces into a solid bar, with or without a wooden core, by means of adhesive material and pressure; next, drying the same, and then cutting or sawing the same into heel lifts of the desired thickness.

### A New Motor.

Louis Charles Errani and Richard Anders, of Liége, Belgium, have patented in this country a new motor, operating as follows: Oil is sprayed into the cylinder behind the piston, and, being mixed with air, is ignited at the proper point by an electric device; the consequent expansion drives the piston forward, the momentum of the fly wheel returning it to its first position. An ejector supplies the oil from the tank to the sprayer, the ejector being connected to a piston blower driven by a crank attached to the main shaft. The general principle is the same as the gas engine.

IT appears from the researches of Dr. D. J. Macgowan, of Shanghai, that the medical virtues of fish oil as a cure for lung complaints was known to the Chinese many centuries ago. But instead of codfish, they take the oil from the shad. Acting on this hint, our apothecaries may perhaps be saved the necessity of sending to Newfoundland for their supplies, as the waters of the Hudson, Connecticut, Chesapeake, and other rivers will afford an abundance of the medicine.

J. M., of Cal., "hopes that the circulation of the SCIENTIFIC AMERICAN will increase till it is read by every mechanic in the land."

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## PATENT VENTILATING AND HEATING STOVE.

The improved form of stove to which the accompanying engravings refer is claimed by its inventor to both heat and ventilate the apartment in which it is placed, to prevent gases from rising in the room, to insure an even and uniform temperature, and also to be cleanly and easy in management. The construction is such as to cause a down draft of air through the fuel, which, the cover being removed, is placed in the basket grate shown in the sectional view. The rear portion of this receptacle, it will be noticed, consists in a single plate, opposite to the smoke escape pipe. Beneath, the stove is hollow, so that the ashes fall down into a drawer or box placed in the ash pit.

In kindling a fire, small coal is first put in the grate, and then the kindling wood, and paper above. On applying the match, the cover is replaced, and the draft is regulated by the apertures therein. In a few moments, it is stated, the downward current of air causes a bright clear fire, and carries away with it all gas due to combustion. The latter has no means of escape except through the apertures above, where it is driven back by the draft and through the small pipe, where it makes its exit. After the fire is well started, the cover can be removed and the coals exposed, giving all the cheerful appearance of an open grate.

Air being drawn in only from above, the cold floor drafts, drawn from under doors and other openings by ordinary forms of stoves, are prevented. Moderation of the entering current is effected both by the orifices in the cover and those in front of the ash pan, the latter allowing a counter flow of air to enter the chimney without passing through the fuel.

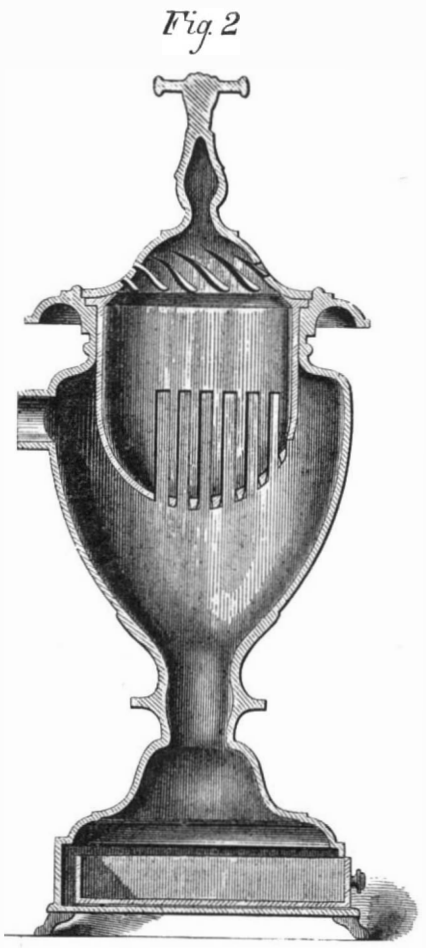
No shaker is needed, so that the grate is easily cleaned, and its contents pushed down into the ash pan by an ordinary poker, thus avoiding the dirt and deposit of dust caused by violently agitating the ashes. When the fire is out, the stove may be emptied without touching its interior with the hands.

For light housekeeping, it is believed that the device is well adapted, and that broiling or frying can be accomplished with great facility. In sleeping apartments, this stove will doubtless be found an excellent arrangement, as its action is to draw off the foul de-oxygenized air. Its appearance, as represented in our engravings, is both neat and handsome, and much more ornamental than the ordinary cylindrical form; and in principle it is quite a novelty.

Patented through the Scientific American Patent Agency, June 3, 1873. For further particulars address the inventor, Mr. T. H. Salmon, 180 West Baltic street, Brooklyn, N. Y.

Fig. 1

Fig. 2



## THE SALMON PATENT VENTILATING STOVE.

## AUTOMATIC CAR COUPLER.

Our engraving illustrates a device for coupling cars which, it is claimed, will instantly attach cars of different hights, even if the difference in level of the drawheads be as great as sixteen inches. The drawhead employed is of cast iron and of the same formation as the ordinary hand coupler, and, it is stated, can be put on old trucks without any difficulty or additional expense.

The pin, A, is of steel, flat sided, and is of greater strength than the ordinary round bolt. As it has to be raised ten inches before the link can be withdrawn, possibility of accidental uncoupling is precluded. B is a revolving tripper attached to the lower end of the pin which, when the pin is set as shown in section in Fig. 2, hangs across the opening of the drawhead. On the entrance of the link the lower extremity of the tripper is pushed to the rear, so that, in revolving on its pivot, its upper end meets the iron of the head. The effect of this is to push the bottom of the pin back, dislodging it from its rest, when, by its gravity, it falls through the link.

In uncoupling, the pin is drawn up as high as it will come, when the notch cut in its lower end catches on top of the drawhead. The tripper then hangs across the latter, and the top of the pin, as represented in the engravings, inclines slightly to the rear. In this position, it is claimed that the cars can be backed for any distance without throwing the pin. The link can then be withdrawn, the tripper breaking away to the front, leaving the coupling in position for action whenever a link enters the drawhead.

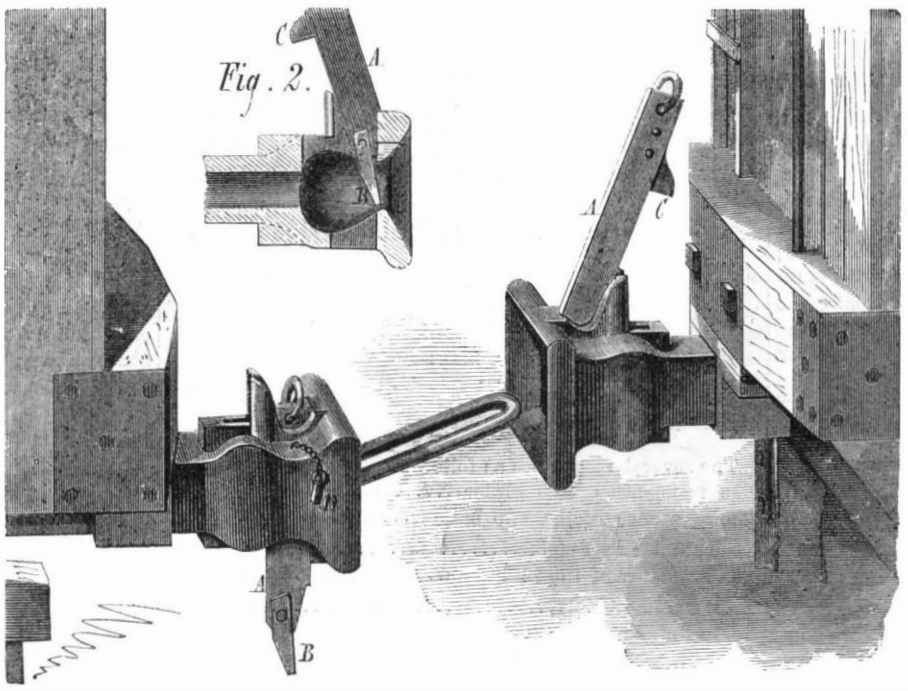
A flange, C, is made on the pin, which, when the latter is down, rests upon the link, holding it in position to enter the opposite drawhead. The pin is perforated with quadrated holes for the insertion of the small bolt, D, so that the link may be adjusted, as shown on the left of the large engraving, at proper angle to suit a higher bumper. This arrangement of the link does not interfere with its up and down play suiting it to the motion of the cars.

It is claimed that the disconnection can be effected equally as well from the ground, platform, or from the top of box cars, and that the link, having increased play, is prevented from becoming bent or broken in use by the drawhead riding it. The device will couple or run on any curve. The cars can be coupled to old hand couplers with greater ease, less danger, and more rapidity, and a whole train may be connected by a single stroke of the engine. Straight or crooked links of sufficient lengths may be employed.

This coupling is in use on the New Orleans, Jackson, and Great Northern, the Mobile and Ohio, the Pennsylvania Central, and other railroads, and we are informed that it has proved in every way successful. Other advantages claimed are simplicity, durability, and cheapness, together with complete immunity from the accidents due to the employment of hand couplers.

Patented by Inge, Wheeler & Co., May 7 and August 6, 1872. For further information address James A. Wiggs, Secretary of the Memphis Automatic Car Coupling Company, Memphis, Tenn.

Fig. 2.




INGE, WHEELER & CO.'S AUTOMATIC CAR COUPLER.

## Vermilion for Dental Purposes.

Having recently seen the statement, that the use of the red sulphide of mercury for artificial gums was highly objectionable, as it might produce salivation, I wish to state, that this fear, in my opinion, is altogether groundless. The sulphide of mercury is very insoluble, even in concentrated acids, and not attacked by alkaline fluids; besides, in the case of gums, each particle is surrounded, so to say, by a film of india rubber, which helps to protect it from being acted upon, if such were necessary at all. I have made very large quantities of vermilion and always taken care to protect the workmen from the effects of the mercury itself, but have never been able yet to prevent them from handling the vermilion rather carelessly, or from inhaling some of the dust; but, in spite of these highly unfavorable circumstances, the first case of mercurial poisoning has yet to make its appearance. I have had the same men in my employ for years, and they all enjoy good health.—*Dr. Alsberg in American Chemist.*

## The Condition of the Earth's Interior.

It seems now to be demonstrated by astronomical and physical arguments—arguments that are independent, it should be noted, of direct geological observation—that the interior of our globe is essentially solid.

The condition of the earth's interior here recognized is, as many readers will have observed, that suggested long ago by Professor W. Hopkins—the author who first offered (1839) a mathematical argument in favor of the earth's either having a very thick crust or being solid throughout. In a paper on "Theories of Elevation and Earthquakes," in 1847, Professor Hopkins argues that the central mass of the earth became solid in consequence of the pressure whenever the temperature within reached a limit that permitted of it; that crusting at surface from cooling commenced afterward; and that between the regions of interior and exterior solidification, there long remained a viscous layer, which, in the progress of time, was gradually contracted by the union of the solid nucleus to the thickening shell.

The possibility of solidification at center from pressure, in the face of a temperature too high for consolidation from cooling, has not been experimentally demonstrated. Yet a number of facts favor the principle. It has been urged that since the solidification of rocks is attended by contraction, that is, by increase of density, and since pressure tends to produce this greater density, therefore pressure may bring about the condition of the solid. The fact that ice, which has less density than water, changes to water under pressure, has been appealed to in support of the conclusion. The pressure to which the material within the earth is subjected is so great that experiment can never imitate it, or directly test its effects. Beneath only one hundred and fifty miles of liquid rock, it would be not less than one million of pounds to the square inch. Less than this may have been sufficient to produce crystalization, and so give rigidity to the viscous rock material, or at least so, after the cooling the earth has undergone. The rigidity of slowly solidified rock is beyond that of glass or steel—or the degree which, according to Sir Wm. Thomson, must exist in order that the earth should be as completely free as it is from tidal movements in its mass.

According to the above, the solid part of the globe consists as regards origin, of three parts.

The central mass, consolidated by pressure; the solidification centrifugal, or from the center outward.

The crust proper, consolidated by cooling; the solidification centripetal, or from the surface inward.

The outer crust, or superficial coatings—the supercrust—made chiefly by the working over and elaborating of the material of the surface through external agencies, aided by the ever-acting lateral force from contraction, and including all terranes from the Archæan upward.—*Professor James D. Dana, American Journal of Science and Arts.*

## Wellesley College.

This is a new institution at Needham, Mass., endowed by Henry F. Durant, and intended for the collegiate training of young women. All the instructors are to be women. The building is in the form of a double cross, five stories high, 600 feet long, 150 feet wide, fitted with all the best modern appliances for lighting, heating, and ventilation. Very many of the studies will be elective, but the classics, chemistry, and probably moral philosophy, will be obligatory. The pupils are to be taught cooking and all the higher kinds of housework, and are themselves to do all such work, in the manner of the Mount Holyoke seminary, where experience shows that one hour a day for each girl is sufficient for household duties. The fees have not yet been fixed, but will probably not exceed $250 a year. The college is to open next year.

THE City of Washington, a large steamer plying between Liverpool and New York, went ashore in the day time, July 5, during a dense fog, on the coast of Nova Scotia, 70 miles from Halifax, and 30 miles from the spot where the Atlantic was wrecked in April, 1873. No lives lost.

THE Cincinnati (Ohio) Industrial Exposition opens September 3, and closes October 4.

THE Louisville (Ky.) Industrial Exposition opens September 2, and closes October 11.

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## GREAT BALLOONS.

The construction of the great *Graphic* balloon in this city, in which Professor Wise is soon to attempt the passage of the Atlantic ocean, lends new interest to the general subject of aerial navigation.

One of the most successful efforts in this direction was that of M. de Lôme, made last year in France. We present herewith an engraving of his aerial ship, from the London *Graphic*. We also give some explanatory diagrams and references, with a full account of the voyage, taken from *Science Record* for 1873:

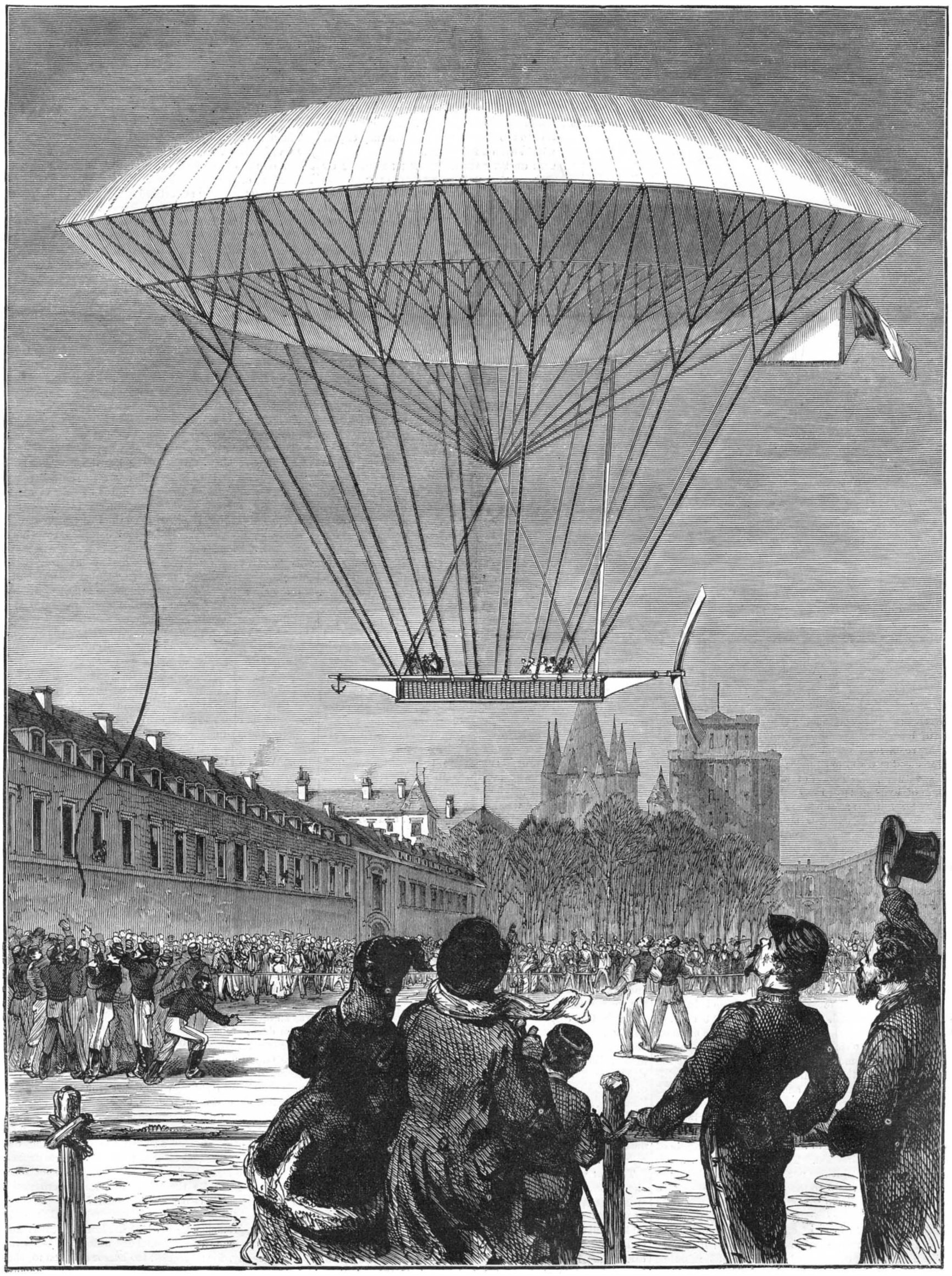
### SUCCESSFUL VOYAGE OF AN AERIAL SHIP.

In continuing the record of what has been done, at home and abroad, to subjugate to man the dominions of the air, we must give attention to the most perfect of aerial machines yet constructed—the aerostat of M. Dupuy de Lôme.

Hydrogen gas was employed, and was obtained by the action of sulphuric acid and water on iron turnings, the gas being afterward washed and dried. The balloon consists of white silk taffeta, lined with india rubber, and again with nanzouk; and to the nanzouk lining, a varnish composition is applied.

That the plane of movement shall be directly under the control of the aeronaut requires that much less resistance should be presented to the air than is the case with the ordinary balloon, and careful calculation led to the following dimensions: Length, 118 feet 6 inches; diameter at center, 48 feet 8 inches; the area of section through the center being 1,862 square feet, and the volume 121,983 cubic feet. M. de Lôme, in his original paper, shows that to obtain a speed of about 5 miles per hour it is necessary to maintain a motive power equivalent to 217 foot pounds per second (about $\frac{2}{5}$ of one horse power), this motive power being preferably obtained from manual labor utilized in rotating a shaft to which is attached a two-bladed screw. By calculation, values were obtained, giving as a result that, for a speed of 5 miles per hour, the labor of four men in turning the winch is necessary, and 8 men for a speed of $6\frac{1}{4}$ miles an hour.

M. Dupuy de Lôme has found that a balloon to be successfully navigated must always be maintained at an equal degree of inflation, in order that the resistance to which the



M. DUPUY DE LOME'S GREAT AERIAL SHIP

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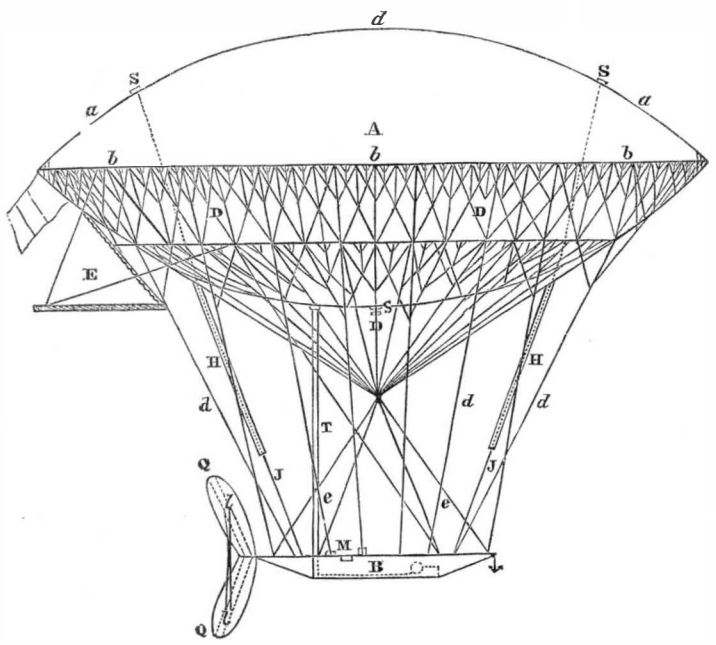
balloon is exposed in its passage through the air should remain constant, and capable at any moment of being defined. The balloon, at starting, being inflated fully with hydrogen, the constant degree of inflation is preserved by means of the hanging tubes, H H. These tubes have the ends open, and are pendant about 25 feet below the balloon. As the gas expands it forces itself down these tubes, while its own pressure in the tube reacts upon the body of gas in the balloon, preserving such an excess of interior pressure as prevents the shape of the outer covering being altered by the wind. Still further to maintain a constant surface there is provided a small internal balloon (termed a *ballonnet*), which, as the gas escapes, through diminution of pressure from the primary balloon, can be filled with air. As the gas expands in the larger balloon it would be forced out of the pendant tubes, were it not that a valve, opening at a low pressure, is attached to the ballonnet. The ultimate proportions of the aerostat, as given by M. Dupuy de Lôme, are:

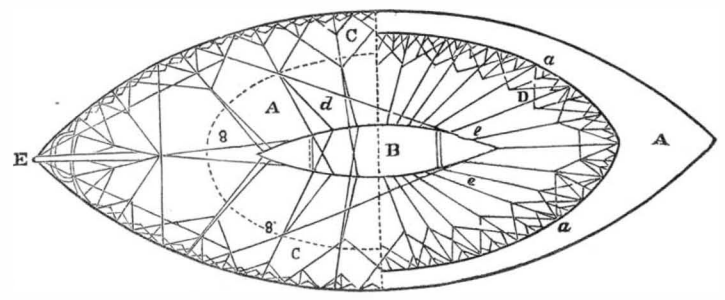
Hight from top of balloon to keel of car, 95½ feet.

Distance between screw shaft and major axis of balloon, 67·1 feet.

Distance of major axis from the center of gravity of complete machine (without ballast), 51 feet.

The rudder is a triangular sail of 161½ square feet area, manipulated by cords from the car.




A, the balloon; B, the car, with D, the net work; *a a*, taffetas covering; *b b*, collar attaching the upper netting to the covering of balloon; *d d*, silken ropes suspending the car; *e e*, balance ropes for the car; 8, small internal balloon, with line of intersection with the balloon; E, gaff sail, or rudder; H, pendant tubes, the length of which regulates hight of the column of hydrogen; J, the cords regulating the valves, S; T, tube for filling small balloon with air; M, crank for working the screw, Q; *l*, stays, strengthening the screw.

We come now to the description of the journey actually undertaken in this machine, premising that instances of so complete a fulfilment of calculation are very rarely occurrent.

The ascent took place from the Fort Neuf of Vincennes. The crew consisted of 14 men, with baggage and provisions weighing 1·13 tuns. There were on board MM. Dupuy de Lôme, Zédé (*Ingénieur de la Marine*), Yon, and Dartois, aeronauts. The instruments weighed 1·75 tuns, and there were 0·27 tun of packages to be carried to the destination of the balloon. The total weight, with 0·59 tun of available ballast, amounted to 3·74 tuns, and the balloon, when thus ballasted, had an ascensional force sufficient to keep it in equillibrium close to the ground. In the first ascent 3 cwts. of ballast were thrown out, the balloon rising from the earth on February 2, 1872, at 1 o'clock. From 1 o'clock to about a quarter past but little more was done than to admire the graceful evolutions of the machine, and the readiness with which it answered to both helm and screw. At 1 hour 15 minutes observations were commenced, and showed the car to be 1,837 feet above the departure station, and moving in a northeasterly direction with a speed of 39 feet per second. The course was then altered to the southeast, at an angle of 83° with the former direction. The number of men working the screw, at 25 revolutions per minute, was eight, the aerostat moving with regard to the earth at a speed of 52·5 feet per second. Afterward this speed increased, with 27·5 revolutions of the screw per minute, to 55·8 feet per second. The speeds given by the form of anemometer employed, as due to the balloon, or rather to the screw, were 7·7 feet to 9·3 feet. The descent was commenced at 2 hours 35 minutes, and was effected at the destination, Mondecourt, near Noyon, without any shock or the slightest accident. We should now consider the results that have been attained in the experiments with the aerostat. They are: The maintenance of a constant exterior surface by means of the ballonnet; freedom from rocking motion, even while two or three persons are walking in the car; and a perfect control, the head of the aerostat being shifted to or kept in any direction, with a maximum force of 60 kilos from the manual labor of the eight men.

These are the mechanical improvements that have been achieved; but the most important result is that an impetus will be given to the study of aerial navigation, now that the science has found a theory seldom paralleled in its application. The remark of one of our greatest men: "Impossible; I don't know the word:" has indeed been practically shown to be an admitted principle by M. de Lôme.

M. de Lôme further proposes to remove seven of the eight men employed to work the screw, and substitute an engine of eight horse power, with one man as engineer. The ballast would then consist of the fuel and water, while the aerostat could be impelled at the rate of 14 miles per hour, at a much larger angle with the plane of direction of the wind. There has thus now been opened to us a new path in the science of aerostation, and it is difficult to limit the imagination to those new wonders we may expect within even a few years.

### THE GREAT BALLOON NOW IN PROCESS OF CONSTRUCTION IN THIS CITY.

The following interesting particulars concerning the new balloon of Professor Wise are given in the *Daily Graphic:*

The main balloon is to be made of unbleached cotton, of which 4,316 yards have been purchased. The greatest strength is required at the crown, and this part of the air ship will have three thicknesses of cloth. The exterior will be coated with a varnish made of linseed oil, beeswax, and benzine. The balloon is to be 110 feet high, and 100 feet in diameter. Gas capacity, 600,000 cubic feet. It will, however, start with only 400,000 cubic feet, as the gas will expand and fill the balloon as the latter rises in the air. When inflated the extreme hight of the apparatus, from the crown to the heel of the boat which will hang below, will be 160 feet.

There will be 14,000 yards (eight miles) of stitching. This is now being done by twelve seamstresses at the establishment of the Domestic Sewing Machine Company, corner of Broadway and Fourteenth street.

The thread used is silk and cotton, the top spool being silk. The valve of the balloon will be three feet in diameter and made of Spanish cedar, with a rubber-coated clapper closing on a brass plate. The valve fixtures and top of the balloon are the essential parts of the apparatus, and are being constructed with special care to guard against any accident of derangement.

The network will be composed of three-strand tarred rope, known as "marlin." The width of the net will be 212 meshes, and its breaking strength will be 58,300 pounds. Five hundred pounds of "marlin" will be used. From the netting 53 ropes, ⅝ inch in diameter, of Manilla, will connect with the concentrating rings. These ropes will each be 90 feet in length, or 4,770 feet in the aggregate. The concentrating rings will be three in number, to guard against breakage, and will be each fourteen inches in diameter, each ring being of wood, iron bound. These rings will sustain the car, life boat, and trailing rope, and will bear the strain when the anchor is thrown out in landing. From the concentrating rings, twenty-four Manilla 1 inch ropes, each 22 feet long, or requiring 528 feet in all, will depend and form the frames for an octagonal shaped car. They will be kept in place by light hoops made of ash. The lower ropes will be connected with network, and over the network at the bottom of the car a light pine floor will be laid loosely, so that it can be thrown out if required. The car will be covered with duck, of which fifty yards will be needed. Attached to the side of the car will be a light iron windlass, from which the boat and trail rope can be raised and lowered as may be desired. From a pulley attached to the concentrating rings a heavy Manilla rope will fall down through the car, and thence to a sling, attached to which will be the life boat. This boat will be of the most approved and careful construction. It will have watertight compartments, sliding keel, and will be so made that it will be self-righting. The boat will be provided with a complete outfit of oars and sails, and to it will be lashed instruments, guns, lines, etc., and provisions for thirty days, all in watertight cases.

The trial rope, by which the aeronaut can maintain any desired altitude without resorting to ballast, will be of Manilla rope, 1¼ inches thick, and 1,000 feet long.

The car will be fully provided with instruments, provisions, etc., independently of the boat. It will be so constructed that it can be taken apart piecemeal and disposed of as ballast. It will carry about 5,000 pounds of ballast, which will consist of bags of sand, each carefully weighed and marked. Among the instruments to be carried in the car, there will be a galvanic battery, with an alarm, two barometers, two chronometer watches, a compound thermometer, a wet and dry bulb thermometer, a hygrometer, componer, quadrant, chart, parachutes with fire balls attached, and so arranged as to explode when striking the water, so as to indicate the direction traversed; marine glasses, two vacuum tubes, a lime stove, etc. A number of carrier pigeons will be taken along, and dispatched, at intervals on the route, with intelligence of the progress of the expedition.

The lifting power of illuminating gas is about 36 pounds to the 1,000 feet, so that the balloon will have a lifting capacity of 11,600 pounds. The pressure will be 1½ pounds to the square inch.

The weight may be summed up as follows:

| | Pounds. |
|---|---|
| Balloon | 4,000 |
| Net and ropes | 800 |
| Car | 100 |
| Boat | 1,000 |
| Dray rope | 600 |
| Anchor and grapnels | 300 |
| Sundries | 300 |
| | 7,100 |

Then 4,500 pounds will be allowed for passengers and ballast.

## Frightful Death of La Mountain, the Celebrated Aeronaut.

The particulars of the frightful fall and death of Professor La Mountain, while making a balloon ascension at Ionia, Mich., on the 4th of July last, are thus described by a correspondent of the Detroit *Post:*

"Among the many advertised attractions of the celebration of the Fourth by our citizens was that of the ascension of Professor La Mountain, of Brooklyn, Mich., in his mammoth air ship. Several thousand spectators thronged the public square for hours before the appointed time. A heavy squall of wind necessarily delayed the ascension for two or three hours, but at the end of that time the air became calm. Under direction of the Professor the balloon was got into position, and its inflation with hot air was commenced. The canvas soon filled, and loomed up nearly 75 feet high. The basket was a willow one of a size sufficient to hold one person comfortably. It was attached to the balloon by six or eight long ropes, which were fastened at the top to a round piece of wood some two or three feet in diameter. The ropes were in no manner fastened together between the top and the basket. As each piece was 100 feet long it seemed, even to inexperienced eyes, that there should have been some webbing or net work, at least over the bag or bulge of the canvas. The fear was generally expressed that some accident might occur by the canvas slipping through between the ropes. It was also noticed that the ropes were unevenly distributed—three or four being in a comparative cluster, leaving the other strands far apart. Nothing was said of the matter, as the Professor, who gave the whole structure a thorough look before taking his seat in the car, made no comment on the fact, and it was thought that his experience was sufficient for the occasion. Everything being in readiness, the words "let her go" were given, and the air ship darted up with great rapidity, while the aeronaut waved his hat to the uneasy multitude, who almost breathlessly watched his flight. Immediately upon leaving the ground the mouth of the canvas began to flap around with great violence. When fully a half mile from the earth and when the whole structure looked no larger than a hogshead, the balloon slipped between the ropes and was instantly inverted. The car and its occupant dropped like a shot; and when the ropes were pulled taut, the round piece of wood was torn from the canvas. With the most terrific velocity the unfortunate man descended, clinging to the basket. That he was conscious was evident from his struggles. With all the intensity of a life with but one chance, he strove to raise the basket above him, evidently hoping to use it as a parachute. He succeeded in his object; but when 100 feet high, he loosed his hold, folded his hands and arms before his face, and, feet first, struck the ground with a dull heavy thud. Then ensued a panic and uproar in the crowd, which is indescribable. Women fainted, men wept, and to add to the confusion the canvas came flying over the crowd like a huge bird. Some one cried out to get out of its way, as it would fall with crushing force. The cry was taken up and a general rush was made for safety, in which many were more or less injured.

La Mountain was crushed into a literal pulp. Not a sign of motion or life was visible when he was reached. Medical examination disclosed the fact that hardly a whole bone was left. Many were ground and splintered to powder. His jaws fell upon his arms, and were pulverized. The blood spurted from his mouth and ears. Where he struck there was an indenture, made in hard gravel ground, five or six inches deep. The corpse was laid out and placed on the public square, where it was viewed by thousands.

The Grand Rapids, Mich., *Eagle* says: "There was but little wind at the time, and the balloon arose directly upward, remaining right over the Court House square, whence it started, appearing of course, to diminish in size, till it was judged, by that appearance and the rate of its upward movement, to be 3,000 feet high. The shouts had ceased, and 10,000 upturned faces watched the diminishing object intently, when the basket was seen to separate from the sack, which hung and wavered about in one spot for half a moment or so, while the basket and man were shooting downward with the velocity of a cannon shot!

As the vast throng of witnesses comprehended the frightfully tragic spectacle, a thrill of intense horror spread through them, as from among them issued one wide spread suppressed groan of agony, for all seemed too horror stricken to shriek. Of course there was no such length of time in the downward

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flying of the devoted man as the reader has occupied in reading these last few lines describing it. From the instant of the disaster to the balloon till he struck the ground, the time was not probably more than fifteen seconds, as measured off on the watch dial by the second hand. At a hight of five or six hundred feet from the earth, the unfortunate man got separated from the basket—in fact it appeared as if he leaped from it intentionally. This certainly made no difference as to the fatality of the fall. The concussion must have killed him just as quickly had he struck the earth with the basket beneath him. Wonderful as it may seem, from the time he sprang from the basket his position in the air remained erect, feet down, till he struck, notwithstanding the greater weight of the head and body, which causes most human bodies to turn and fall head first. It is possible he had acquired a faculty of controlling his position in the air by athletic force. Perhaps, in the hurried thoughts of despair, he fancied he might, by striking feet down, be spared from death. But the indescribable swiftness of his descent must have knocked the breath out of him, even had he struck on a newly made hay stack. Many people declare that they saw such movements of his limbs and even expressions in his face as showed him to be alive and conscious until he struck. But this is considered by the greater number to have been entirely improbable. His shooting downward through space with lightning-like swiftness deprived him of all breath and sense of life, undoubtedly, while part way down. Indeed, it is hardly possible that he intentionally jumped from the basket. It is more likely that he fell from it when he had no longer any power to hold on to it. With terrific violence he crashed upon the earth, feet down, his legs being driven up into his body, and all but his head instantly mashed into a sickening, quivering mass of spouting blood, protruding bones, and dropping flesh. His feet struck into the earth several inches. He struck a few feet from the jail wall, only about eight rods from the very spot where he went up. Down came the basket right after him, and his hat came wavering down. What became of the sack of the balloon is not known."

La Mountain's name is familiar to the readers of the SCIENTIFIC AMERICAN. He was the hero of many a remarkable balloon ascension, and had great confidence in his abilities to navigate the air. But it is evident that he was careless, in the present instance, in respect to the mechanical details of his air ship, and the loss of his life is the sad result. La Mountain was one of the party who accompanied Professor Wise in his famous aerial flight from Missouri to New York in 1859. On that occasion, La Mountain narrowly escaped drowning in Lake Erie.

### Action of Water on Lead.

The most general results of Sir Robert Christison's inquiries are: 1. That the purest waters act the most powerfully on lead, corroding it, and forming a carbonate of peculiar and uniform composition. 2. That all salts impede this action, and many prevent it altogether, some of them when in extremely minute proportions. 3. That the proportion of each salt required to prevent action is nearly in the inverse ratio of the solubility of the compound which its acid forms with the oxide of lead.

The corrosive action of water upon lead has often been confounded with other causes of corrosion, and the water has borne the blame. Thus the true action has been confounded with the corrosive action of potent agents accidentally coming in contact with the metal in the presence of water, as, for example, when a lead pipe has been led through fresh mortar, which is frequently or permanently kept moist, or when lumps of fresh mortar have been allowed to fall upon the bottom of a lead cistern.

The true or simple action of water has not unfrequently been confounded also with the effects of galvanic action. Thus, if a lead pipe or cistern be soldered with pewter solder and not with lead, erosion takes place near the line of junction of the solder with the lead. The presence of bars of other metals crossing lead, or bits of them lying on it, will also develop the same action; and some facts seem to point to the same property being possessed in a minor degree by some stony and earthy substances. This observation may explain the local erosion sometimes observed in cisterns containing hard water; since, if galvanic action be excited, it will be increased by the fact of saline water existing more largely in these waters than in soft or comparatively pure water.

Lastly, some observers have contradicted former statements, because under certain circumstances, which led them to anticipate no action, they nevertheless found lead in water, but only in extremely minute and unimportant proportion. The test for lead, hydrosulphuric acid, when employed in the way now usually practiced, is so delicate as to detect that metal when dissolved in ten million parts of water, or even more. Facts, however, warrant the conclusion that the impregnation must amount to at least ten times this quantity before water can act injuriously on man, however long it may be used.

### Tin as a Filling for the Teeth.

Dr. E. W. Foster, in *Dental Cosmos*, says: Tin possesses many considerations of fitness for stopping carious teeth not held by gold. Its freedom from being suddenly affected by thermal changes, its plasticity and ease of adaptability to all the irregularities of the cavity, its permanency or stickiness in the cavity, its comparatively low specific gravity, and other favorable features, are some of the prominent facts connected with this really fine metal, that make it no mean competitor with gold in the daily and important question of filling and preserving the teeth. The prejudice of most operators is generally, we well know, against this foil, and from grounds we think not entirely reasonable.

We have occasion to use it much in our practice, sometimes for permanent fillings, and sometimes to precede gold in the soft vascular teeth of children and youth. As to the extreme permanency of tin when removed from the attrition of mastication, it will be difficult to determine. Yet we have seen tin fillings between thirty and forty years of age, still serviceable and in good condition.

The low specific gravity of tin, and its non-irritating nature, resembling in the latter trait, though in a less degree, the same remarkable quality possessed by lead, enable it to rest with comparative non-disturbance even in the midst of vital presences.

For this reason lead had long ago been used for filling teeth in many countries of Europe. In France especially it was the material *par excellence* for such purposes; and it may not be uninteresting to remark, that the very word in the French language used to signify the term "filling teeth," is "*plomber*," a word of historical significance in this connection, being derived from the name and the fact of lead being used as a stopping for teeth, even so far back as the formation of that language.

Though tin is easier of manipulation than gold, the same care, to the same end, should govern its introduction into the cavity, its condensation and finish afterwards. If the cavity is large, and nerve nearly exposed, the use of polish-powder (oxide of tin) moistened with water or glycerin, and applied to the walls of the cavity before the introduction of the tin, will produce agreeable and substantial results.

### Cornell University.

The attention of our readers is called to the commencement of the above well known institution published in our "Business and Personal" column. The next scholastic year begins on September 8, so that ample time is afforded between that date and the present, for those desirous of availing themselves of the advantage of the various courses, to make all necessary preparations. Young mechanics, engineers and siudents in the various professions and trades will find no institution in the country better adapted to give them a sound, practical as well as theoretical, basis for their future callings than Cornell. Five hundred free scholarships are in existence, and the college is liberally endowed with every requisite for thorough and systematic instruction.

### Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From June 20 to June 26, 1873, inclusive.

BRAIDER.—E. H. Alexander, New York city.
EXTINGUISHING FIRES.—J. W. Stanton, Brooklyn, N. Y.
GAS.—J. H. B. M. Randolph *et al.*, Detroit, Mich.
PICKER MOTION.—T. C. Morton, Waterbury, Conn.
PRESERVING MEAT, ETC.—A. T. Jones, Clinton, Wis., *et al.*
PRESERVING WOOD.—C. Brown (of Albemarle, Va.), London, Eng.
PRINTING OIL CLOTH, ETC.—W. H. Townsend, New York city.
SEWING MACHINE.—Lev Griswold, New York city.
STEAM BOILER.—J. Griffith (of New York city), London, Eng.
TREADLE.—S. K. Herrick, Boston, Mass.
TUNNELLING.—D. C. Haskins, Vallejo, Cal.

## Recent American and Foreign Patents.

### Improved Relisher and Wedge Cutter.

Wesley J. Hoskins and Amos D. Rowe, Essex, N. Y.—This invention consists of a combination of instrumentalities whereby the relish of a door rail may be cut, and the part to be removed may first be cut into wedges and then removed by a succession of operations, all of which are performed with one machine. A gang of three saws cuts three parallel slits on the swinging frame which is connected to a tilting table. Over the saws are mounted the two saws for cutting the diagonal slots on an arbor. In front of these the stationary cutters are arranged for cutting out the relish. In the first place, the rail is put on the table and moved along one of the guides, properly adjusted therefor against the saws, till the shoulder of the rabbet comes against a stop by which the saws cut a slit; then the table is tilted upward by a handle, without moving the rail from its position on the table, to other saws which make the diagonal cuts; from the saws the work is moved up to the cutters above; then the treadle is forced up and the wedges are cut off, leaving the relish, and making the wedges complete.

### Improved Corn Harvester.

James H. Spears, Kennedy Wells, and Robert Wells, Piper City, Ill.—This invention has for its object to furnish an improved machine for detaching the ears from the stalks, removing the husks from the ears, and depositing the husked ears in a wagon. To a cross bar are attached the ends of the shanks of the three guides or gatherers. Rollers are arranged parallel with each other, in pairs, and upon the opposite sides of the shank of the central guide. These rollers have corrugations upon their lower or forward ends, the corrugations of the rollers of each pair running in opposite directions, and extending longitudinally along the upper or rear part of the said rollers. To the rear journals of the rollers of each pair are attached small gear wheels, meshing into each other, so that the rollers of each pair may be revolved together with equal velocity and in opposite directions. The journals of the inner rollers are extended to the rearward, and connect by gearing with a shaft on which is a roller. An endless carrier passes around a roller pivoted in a slot in the lower part of the shank of the central guide and around the roller attached to the shaft, and by which the said carrier is driven. The carrier receives the ears of corn from the rollers, carries them up and discharges them into the inclined spout, down which they slide to other rollers which are provided with short teeth arranged spirally, which tear off the husks from the ears, and at the same time carry said ears along and discharge them upon the elevator, which passes around rollers pivoted to the upper and lower ends of the elevator frame and discharges the husked ears into a hinged spout, down which they slide into a wagon.

### Improved Medical Compound and Medicated Food.

Jean M. O. Tamin, of New York city.—This invention consists in extracting from vegetable substances those most nourishing ingredients which are combined with phosphorus, and in subsequently adding them to the substances to be eaten or imbibed as articles of food or medicines. Thus, for example, it is proposed to withdraw from vegetables, such as peas or beans, the ingredients above referred to, discarding the indigestible, or at least with difficulty digestible, residue of such vegetables, and to add the matter extracted to chocolate or other suitable article of food. A certain quantity of peas, for instance, is powdered and then treated with water. The mixture is filtered, and so much of the moisture is evaporated as to leave the remainder of a more or less viscid consistency. Gastric juice or finely cut pieces of a calf's stomach are next added. Finally, the mixture is dried at a moderate heat. The substances with which the phosphorus is thus mixed it is proposed to call "phosphorine."

### Improved Washing Machine.

James W. Hannah, Sticklerville, Mo.—This invention has for its object to furnish an improved washing machine. The body of the machine is made semicylindrical in form, having vertical wooden ends and curved zinc bottom and sides. In the middle part of the ends of the box, leading downward from their upper edges, are formed vertical slots to receive the journals of the rubber, the ends of which enter grooves in the vertical bars or standards attached to the outer sides of said ends. To the inner surface of the bottom and sides of the box are attached round cleats. The end plates of the rubber are made semicircular in form and are connected and held in their proper positions by the cross rounds. To the rounds, at equal and short distances apart, are secured the concave edges of segments of ring plates. To the end plates and shaft are attached levers, the upper ends of which are connected by a round which serves as a handle in operating the rubber. By this construction the plates, being vertical, pass easily through the water and without carrying the water with them, which makes the labor of operating the machine very slight, and, at the same time, the scalloped edges of said plates, operating upon the clothes, clean them in a very short time.

### Improved Animal Trap.

John Gould, Clinton, Pa.—This invention has for its object to furnish an improved animal trap, which shall be so constructed that the entrance of the animal will reset the trap for the next animal. By suitable construction, when the trap is set, as the animal enters the box and steps upon a platform, he tilts said platform, which draws back a catch lever and allows a wheel to be revolved by a spring until a pin, upon the other side of the wheel, strikes a stop spring. This movement closes the doors and leaves the animal shut up in the box. The animal then sees light entering through another box, and, trying to reach it, he raises a gate, steps upon and operates the trip platform, and passes into a third box whence he cannot escape. This movement withdraws the catch lever and allows the wheel to revolve until the next pin upon its other side strikes against the other stop spring, opening the doors and again setting the trap.

### Improved Knapsack.

George H. Palmer, first Lieutenant 16th U. S. Infantry, Beloit, Wis.—In this invention the frame is made of small, tough, flexible pieces of wood, butted together at the end and secured at the corners by strong duck, canvas, or other heavy cloth, in which the sticks are bound at the edges. Between the sticks are strong thick pieces of leather fastened to the cloth and turned around the corners. They are to hold the sticks apart the width of the cloth pieces, and to afford sufficient strength for holding the covering and the straps, which are attached to them. About half an inch from the end the wood pieces are tied together by strong leather strings. The cloth pieces of each corner are connected together by straps which prevent them from sliding up on the rods, and bind the frame strongly together at the corners. The cover, of flexible material, is shaped so as to envelope all sides except one, and, having flaps, is fastened on by metal loops with a toggle piece, the said loop being inserted through the canvas and leather corner pieces; and the flaps are provided with means of buckling together when folded down. The lower loop straps also unite with the straps, the said straps passing through the metal loops and meeting and buckling together at the middle of the bottom of the knapsack. The loops are connected to the knapsack by the metal loops, that they can be readily shifted as may be required for changing the knapsack sides about. The shoulder straps are connected to the back plate by rivets, which are suitably arranged to allow the straps to turn freely as required in separating and adjusting them on the wearer, also for shifting them about to different positions for ease in sustaining the load. The knapsack frame is covered with linen or cotton duck, having on one side a waterproof flap of vulcanized rubber cloth. It may be reversed on the back by simply hooking it from the back pad, turning it, and changing the supporting straps to the opposite side. By this means the canvas back may be turned outward in hot weather, and the waterproof flap outward in rainy weather. The knapsack may be worn at almost any place desired on the back.

### Improved Friction Attachment for Securing Pulleys to Shafts.

Henry Cox, Peterborough, Canada.—The invention consists in the improvement of friction attachments for pulley shafts. A shaft carries a loose pulley in the hub of which is formed a mortise, at the sides of which are formed one or more lugs to receive a pin by which an eccentric disk is pivoted to said hub. By this construction, when the pulley is turned in one direction it will run freely, but when turned in the other direction the eccentric will take hold of the shaft and carry it with the said pulley in its revolution. This secures the pulley on the shaft or prevents its retrograde motion.

### Improvement in the Manufacture of Zinc White.

Nathan Bartlett, of Bayonne City, assignor to himself and Samuel C. West, Elizabeth, N. J.—The furnace has three chambers, an upper, middle, and lower one. The fire is built at one end and delivers the lighter vapor into the upper chamber and the heavier into the middle chamber, the latter vapor passing out at the chimney, while the former, after traversing the length of the furnace, descends in two passages to the lower chamber, where, after having twice traversed the whole length, it enters the discharge chimney. This improvement in the arrangement of the furnace consists in making the middle chamber funnel-shaped, or approximately so, by which to concentrate the heat, as before stated, and thus work out the oxide from the ore much cleaner than it has ever been done before, and thus increase the percentage of gain. In carrying out this improved mode of working the furnace the chamber is in four imaginary sections. When fully heated and charged a batch of the residuum at the opening and the three other batches are shifted along one stage, and a fresh batch applied, thus working the ore along intermittingly as the reduction proceeds, and at the same time supplying the fresh ore and removing the refuse without cooling the furnace down or losing the time now lost by discharging at the mouth of the furnace and recharging again, the doors remaining open the while so that much heat is lost. For introducing the oxygen to combine with the gases evolved from the coal in the furnace, also the vapors of the ore, and thus to insure more perfect combustion, two blast pipes discharge into the chamber, so that the air, which is forced in by any suitable blower, unites with the gases as they emerge from the passages and burns intensely.

### Improved Horse Power.

Joseph Milbourn, Millport, Ohio.—The object of this invention is to improve and render more useful the horse powers which are used for thrashing grain, and other purposes; and it consists in adjustable extension levers, in combination with the old or ordinary levers, and in stay rods which connect the ends of the extension levers, and in draft rods attached to the stay rods. There are but two draft rods, but there may be a draft rod for each lever, if desired. By this arrangement the draft is applied to the ends of the extension levers, which results in a great saving of power.

### Improved Washing Machine.

Nathan F. Reed, North Wolcott, Vt.—This invention has for its object to furnish an improved washing machine. A set of rollers, the journals of which revolve in bars of such a size that the rollers work clear of the bottom of the box, form a roller bottom to said box. A second set of rollers, the journals of which revolve in bars which are made shorter than the bars above mentioned, are connected by boards, thus forming a roller platform or rubbing board. To the sides of the middle part of the platform are secured staples upon which hook notches are formed in the lower ends of bars which are pivoted to levers. By this construction, by moving the upper ends of the levers back and forth, the roller platform will be moved back and forth, rubbing the clothes between it and the roller bottom, washing them quickly and thoroughly. By suitable means the roller platform may be held down upon the clothes with any desired pressure.

### Improved Implement.

Henry B. Whitehead, Holly Springs, Miss.—This invention relates to an improved tool for use as pliers or as a hand vice; and consists in an arrangement of jaws having perpendicular toothed shanks, and transversely slotted handles provided with teeth on their pivot ends for engaging with the jaw shanks, whereby a parallel motion of the jaws is produced. By tightening a thumb screw the jaws may be set and used as a hand vise. The handles when used as calipers and dividers, and opened to the desired angle, are thereby held in position. When the handles are thrown out as far as the frame will allow, the jaws may be moved one or two teeth, and can then be used to gripe larger bodies than in the former state.

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### Improved Medical Compound for Liver Diseases.

Joseph M. Cunningham, Mount Morris, Ill.—The object of this invention is to supply an efficient compound for diseases arising from a deranged condition of the liver and complaints having their origin therein. It consists mainly in extracting with alcohol the bitter part of different roots and herbs, to be mixed, after percolation, with water, sugar, and the oil of sassafras.

### Improved Railroad Crossing.

Robert J. Hughes, Ryneer, Ind.—This invention is an improvement in the class of switches or railroad crossings in which the rails of the side track are elevated to allow the wheels of the cars to pass above the rails of the main track. The cross ties are placed higher than usual to reach the level of the crossing rails, and are placed nearer together at the switch. They are suitably notched for the reception of the main rails, to keep them on the level of the main track. The crossing rails are placed on the elevation of the ties, and are thereby raised above the level of the main rails. Between the rails of the main track is laid the pivoted or spring rail, the end of which is curved from the main rail, and, by suitable means, is prevented from being lifted off the track. The flanges of the wheels pass between the main rail and spring rail by pressing the latter sidewise. A flange plate is placed on a level with the top of the main rail adjacent to end of the spring rail and serves the purpose of conveying the flanges of the car wheels from the spring rail to the raised side rails. The guide rail placed opposite the flange plate, on a level with the crossing rails, assists the wheels to pass over the flange plate to the side track.

### Improved Presser Foot for Sewing Machines.

George W. Allerton and Zenas M. Powers, Robinson, Ill.—This invention consists of a glass disk pivoted to the supporting arm in the axis of the needle by a hollow pivot through which the needle works, the object of which is to have the presser turn with the work when curved seams are to be made, so that the work can be turned more accurately and easily than it can be with the ordinary non-turning foot. A rotating presser of this kind is very useful in equalizing the length of the stitches, by the facility it affords for turning the work accurately.

### Improved Peach Cutter.

William J. Hill, Fayetteville, Tenn.—The invention consists in the improvement of peach cutters. In using the machine the peaches are laid blossom end downward upon cutters, with one hand, in such a position that the seam of the peach may be in line with the wing or straight cutters, and a lever is operated with the other hand to bring a block down upon the peach. As the block presses upon the peach with sufficient force to hold it in place, the first hand is removed from the peach and the block is pressed down upon the edges of the cutters, the parts of the peach dropping into the spout, and the pit sticking in the cavity of the cutters until it is pushed out by the next pit.

### Improved Scaffold.

Daniel Y. Miller, Huntsville, Ill.—The object of this invention is to construct a scaffold for the use of painters, carpenters, and others, which may be easily set up and taken to pieces and readily transported. The invention consists of two main supports resting on standards and composed of several pieces, connected by strong staples, the uppermost pieces suspending, by block and tackle arrangement, an adjustable platform, which may be elevated to the full hight of the supports.

### Improved Cotton Planter.

George Paterson, Waynesborough, Ga.—This invention consists in the improvement of cotton planters. Behind the plows are the guano hoppers, supported on iron rods or bars, or other supports, adjustable toward or from the frame. Vertical slides are arranged in the hoppers with pockets to fill with the guano as they rise up in the hopper, and carry it down to discharge below. Said slides are pushed down by tappets on the seed-dropping wheels, and they are forced up by a spring, when the tappets escape from projections. The pockets are varied as to capacity by adjustable blocks, held by binding screws so they can be readily loosened, shifted, and fastened again. The relative arrangement of the guano droppers and the seed droppers is such that the seed and the guano will be dropped together. It will be seen that a great economy of labor will be effected by the use of this machine, which combines eight separate and special machines in one, requires only one horse or mule and one attendant, and neither the horse nor the attendant has to walk along the ridges and tramp the earth down, as when separate machines are used. The principal improvement in the device consists in the vertical pocket slide, arranged to reciprocate up and down in the guano dropper.

### Improved Cut-off and Regulating Cock for Gas.

Charles E. Seal, Winchester, Va.—This invention consists in a cock or valve, attached on or near the gas meter or on gas-conveying pipes, and having a flexible connection attaching it to valve-lifting mechanism that has been arranged in the room or apartment where the gas is used.

### Improved Horse Hay Rake.

Lyman Litchfield and Jay Spencer Corbin, Gouverneur, N. Y.—This invention consists in a novel means whereby the driver can conveniently use both the foot and hand simultaneously in elevating the rake, in novel means whereby the rake may be adjusted by the driver without leaving his seat, to run on the ground or at a slight distance thereabove, and finally in a peculiar construction of rake-tooth head which allows each tooth to be rigidly held and independently moved, or to be raised with the others.

### Improved Mode of Splitting Rock.

Patrick Croghan, Cockeysville, Md.—This invention consists in the method of splitting off blocks of stone by boring subjacently beyond the longitudinal middle line of the block, placing the side pieces across said line and causing the up and down pressure of the wedge to be exerted inside and not on the edge of the rock.

### Improved Saponifying Apparatus.

George W. Hatfield, Nashville, Tenn.—This invention relates to means for applying heat, pressure and mobility to the alkali and fatty matter used in the process of saponification, so that the product will be uniform in its character and thus adapted to make a soap of the best and most reliable quality. It consists in arranging spirally upon a common shaft a series of paddles or agitators, which are continually lifting and transferring the fluid matter from one end to the other of a close boiler or mixing chamber.

### Improved Plow.

Lewis B. White, Norfolk, Va.—This invention consists in making the landside of a turn plow reversible by a peculiar construction of ends and bottom flanges, so that two landsides are virtually made of but little more metal than one as now constructed. The invention also consists in applying a slotted adjustable wedge between the beam and handles of turn plows, that they may both be held solid and without a chance to move out of their respective positions under strain.

### Improved Process of Preparing Corn for Grinding.

William Standing, Du Quoin, Ill.—The object is to produce a superior article of corn flour and corn meal, by subjecting the corn, before it is manufactured, to a steam drying process with steam of high pressure, and with a thorough ventilation of the grain for the rapid escape of all the moisture that may accumulate in the corn while passing through the drying process. The corn is passed over and through several cleaning machines, similar to those used in the cleaning of wheat, then it is elevated into the dryer, having a capacity of about fifty bushels, more or less. But before the corn is admitted into the dryer, the slide, which is placed at the bottom, is closed until the dryer is filled, then the valve is opened sufficiently to permit it (the grain) to escape only as fast as it becomes thoroughly dried. The valve is adjustable to suit any circumstances which may conduce to a slower or more rapid rate of drying. The passing of the grain through the dryer containing a high pressure of steam, say, from seventy-five to one hundred pounds to the square inch, more or less, with the corresponding temperature, is for the purpose of having the latent heat of the steam penetrate thoroughly the germ, phosphate, dextrin, and starch portion of the corn, as also its oil gluten, and neutralize the strong rank smell and taste peculiar and common to all corn, but more especially in the large starch-bearing kinds. As the corn leaves the dryer it is conveyed to and passed over or through machines for the purpose of cooling thoroughly before grinding. The corn is then ground on the best French burrs, somewhat finer than the ordinary style of grinding.

### Improved Lawn Mower.

Theodore Soetbeer, Irvington, N. Y.—This invention has for its object to furnish an improved instrument for shearing the edges of grass plots along the edges of walks, beds, etc., where the grass cannot be cut by the lawn mower. To the lower end of the standard or frame, in an inclined position, is secured the lower or stationary blade of the shears. To the blade, near its rear end, is pivoted the rear end of the upper blade. To the latter, near its rear end, is pivoted the lower end of the connecting rod, the upper end of which is pivoted to the crank. Several holes are formed in the connecting rod to receive the crank to enable the instrument to be adjusted. The crank is attached to the end of a shaft, to which, within the frame, is attached a small grooved pulley around which passes a band which also passes around a larger pulley attached to a wheel, which revolves in the lower part of the frame. The wheel is designed to roll along the ground at the side of the edge to be sheared and carry the machine forward, and at the same time by its revolution to work the movable blade. The standard and frame may be adjusted upon each other to adjust the lower blade to the proper hight above the ground.

### Improved Match Plane.

James Edwards, New York city.—This invention consists in the improvement of match planes. The face of the tool for cutting the tongue is formed in two parts. An adjustable piece is fitted into a rabbet of the stock, and is made adjustable laterally thereon. By moving this piece out or in, the length of the mouth of the tool is varied so as to correspond with the width of the adjustable iron. A guide is made adjustable on the face of the tool by means of screws and slots, and a gage is provided for regulating the depth of the cut. The iron is made in two parts. By means of this adjustment the space is made broad or narrow to receive the tongue, which is cut of corresponding size. Any ordinary plow iron may be used in the grooving tool, and the tonguing tool may be adjusted to suit the groove. With the adjustable tool and an adjustable grooving tool, the machine is prepared to tongue and groove boards or lumber of all ordinary thicknesses.

### Improved Cotton and Rice Chopper.

Joseph B. Underwood, Fayetteville, N. C.—This invention consists in supporting the axle of a cotton cultivator in a U shaped bar hinged at one end and adjustable at the other, so as to regulate the depth at which the plows shall run in the ground. It also consists in horizontal chopping knives arranged to operate in the rear of the cultivator plows. It also consists in a novel arrangement of the plow standard and the chopper bar, so that the choppers will be shielded from the moving soil, or other obstacle. It also consists in means for throwing the choppers out of gear with their operative mechanism.

### Improved Soldering Apparatus.

Wm. D. Brooks, Baltimore, Md.—This invention consists in bringing the cans upon a carriage truck or car so as to be centered by the cap holder, and so that the seam which is to be soldered shall come directly under the burners of the soldering apparatus and the pipe. The can is then revolved and quickly heated while the bit of solder that is cut off in the holding tube falls through the lower end thereof and rests with one end on the can, being melted gradually as the can revolves.

### Improved Method of Soldering Cans.

George D. Brooks, Baltimore, Md.—This invention has mainly in view to form a tight joint at the junction of a can body with its top and bottom before the solder is applied; otherwise the solder finds its way through, is wasted, and does not form so strong, full, and reliable a joint. The invention consists in the method and in the particular means by which this object is accomplished.

### Improved Plow Truck.

John Flanagin, Pawnee City, Neb.—This invention relates generally to gang plows, and particularly to the mode of arranging plows of unequal size in the same gang so that rows may be plowed out deeply, except in close proximity to the plants, where the brace roots would be too much fractured and injured; also, to adapt a single turn plow to be worked without necessitating either horse to tread in the furrow or upon the plowed ground. The invention consists in a triangular wheeled plow truck, in whose front is the clevis, to which the whiffletree is attached, and at whose rear are placed one or more adjustable clevises, to which are attached the plow or plows.


# Value of Patents,

## AND HOW TO OBTAIN THEM.

## Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*. This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer canonly be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

### How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office. Such a measure often saves the cost of an application for a patent.

### Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

### Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate Address MUNN & Co., stating particulars.

### To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

### Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

### Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, for full particulars.

### Design Patents.

Foreign designers and manufacturers, who send goods to this country may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

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### Foreign Patents.

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## Notes & Queries

A. asks how to make a touchstone for testing gold.

T. F. asks: What other ingredients mixed with hydraulic cement and plaster of Paris will make a hard and fixed lining for the hollow iron shafts of mantels?

J. N. F. asks: Is there a soft white metal, that will not rust, as cheap as common gray iron? Something similar to white clothes line metal is wanted.

W. H. M. says: I have a mirror, and the heat of a stove has affected the glass so that it is worthless; there seems to be a blur over it, and it looks as though it were covered with dust. Is there any way to restore it?

J. H. F. wants an instantaneous black walnut stain for soft woods. "I want to dip the pieces into the stain tank and let the stain strike in as they drain on a rack."

J. S. C. asks for information respecting a plant or fungus known in the South as California moss or beer moss, used for making molasses beer. Would the beer be deleterious to health?

A. K. asks: Is there a book published on phosphorescent compounds?

E. J. B. asks (1) how to put a polish on steel or iron, such as there is on a chisel or butcher's knife. 2. What is a good preventive for rust, for use on bright articles exposed to open air? 3. How are locks japanned giving them such a hard glossy color?

## Answers to Correspondents

A. will find recipes for Worcestershire sauce on pp. 249 and 281, vol. 26, and one for waterproof blacking on p. 90, vol. 26.—R. C. will find the description of Hugo Tamm's manganese process on p. 21, vol. 28.—L. S. C. can temper mill picks by following the directions on p. 106, vol. 25.—A. B. can harden set screws and similar articles by using the process described on p. 90, vol. 26.—J. G. D. can find processes for tempering steel in many of our recent numbers. We cannot repeat them so frequently as many of our correspondents seem to desire.—J. W. T. is correct; W. A. J. made an error.—C. S. P. will find directions for kalsomining on p. 351, vol. 24.—H. S. can make Pharoah's serpents by following the instructions given on p. 410, vol. 28.—A. N. will find a cement for china described on p. 346, vol. 24. Try your perpetual motion, and get the water up your siphon, if you can.—B. W. Jr. will find an account of the method of raising pearls on p. 305, vol. 26.—A. J. A. and C. T. B. should read H, C. Baird's advertisements in our journal.—P. T. R. will find an answer to his queries about magic lanterns, etc., on p. 27, vol. 29.

E. M. G. and others ask us for a rule for proportioning screw cutting gears. Answer: Multiply the screw on your lathe and the thread you wish to cut by a given number. If you want 10 threads to the inch and your lathe screw is 4 threads to the inch, multiply by 8, 10, or 12. The result will be 80 and 32, 100 and 40, 120 and 48, and so on.

J. A. G. & Bro. ask: What is the decision of the Supreme Court referred to on p. 336, vol. 28, in regard to rights of assignees under extensions of patents? We do not find it given in present volume. Answer: The article on p. 336 says: "We published last week." Look on p. 328.

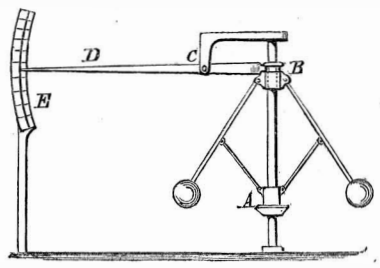
J. E. E., of Pa., asks: Will some one give the scientific cause of the light produced from lightning bugs and light wood. In a dark night I have held a lightning bug to ascertain the time by my watch, and often wondered what produced it. Is it electricity like the electricity produced by stroking a cat, more distinctly seen from a black cat? Electricity would not seem to be the cause of light in light wood. In either case, it would seem that the sun is not the only source of light unless it is held that as it is the source of all life (both animal and vegetable) these light sources could not have existed without the sun. Answer: The light produced from lightning bugs and other insects is due to the secretion of phosphorus in the form of a substance termed noctilucine. It is secreted by a special organ, just as bile is produced by the liver. Noctilucine can be obtained from the bugs mentioned, from glow worms, from phosphorescent marine animalculæ, from decaying fish, flesh, light wood, etc. Thus obtained, it yields light by contact with air, the phosphorus being thereby oxydized. In Science Record for 1873, at page 467, an interesting chapter on this subject is given.

P. S. A. says, in answer to a great many queries on cutting old files: Acid is a good means of cleaning old files, and there it ends. It will destroy any cutting edge that may have been left on the files. The only way to renew old files is to send them to a file manufactory, have them annealed, ground out, and then cut as if the blank were new. If the steel in the files is good and the blanks heavy, this will give satisfaction. Acid has done more to condemn the recutting of files than all the poor work that has ever been put on file blanks.

T. S. S. says that E. S. can remove iron rust from tools by using carbon oil. Apply it, and in a few hours rub it with fine sand paper; it will lift it off or remove it immediately.

J. S. C. asks: What is the oil of rhodium? Answer: No such substance is mentioned in the pharmacopeia. A correspondent once informed us that a quack recommended its use, and then offered to sell the stuff at a very high price.

A. A. N. (1) encloses a sketch of a machine for measuring the velocity of the wind, and asks: Will it work? In it a governor, similar to that in an engine, is attached to a common windmill. A and B are sleeves that revolve around a spindle. B slides up and down,

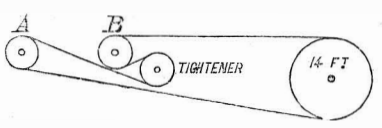



while A does not. At A is a bevel wheel through which the motion is communicated from the windmill. D is an arm or pointer pivoted at C, and also to the sleeve at B; while the other end moves over the graduated part of a dial, E. As the balls rise or fall, by the force of gravity overcome by centrifugal force, the sleeve B rises and falls also, and with it the end of the pointer, D. If it will work, how can I graduate it? How can I find the position of the pointer when the wind blows at the rate of 10 miles an hour? 2. How can I whiten blocks for engraving, so that pencil marks will show? I have used the white off cards until my cards are all gone. Answers: 1. The contrivance described by our correspondent is not novel. It will work, if the scale can be graduated; and this can only be done by experiment. There are many anemometers, or instruments for measuring the velocity of the wind; but we do not know of any that record it with perfect accuracy. 2. Use Chinese white, in the form of fine powder, and apply it to the block with the finger.

A. C. S. asks: Which is the most economical style of boiler to use, say to the amount of 100 horse power? Answer: Your choice would probably lie between the locomotive or tubular, and some form of the sectional boiler. We could not give you any definite advice, without knowing more of the circumstances of the case. We would also say, in this connection, that these columns are for matter of general interest to all our readers. Special suggestions as to what particular machines to use in individual cases cannot be given here. Information of this kind should be obtained from some reliable consulting engineer. Your other query, as to bevel gears, was answered on page 11 of our current volume.

J. H. K. says: A friend says that the crosshead connected with the piston rod of a locomotive moves forward in the guides and remains stationary until the guides slip the length of the stroke, then forward again. My idea is that the crosshead moves backward and forward in the guides. He also says that the piston rod moves forward twice as quick as the guides slip up the length of the stroke. It is understood that the wheels do not slip. Answer: Probably you and your opponent are looking at the matter from different standpoints. If the driving wheels do not slip, the whole locomotive, and consequently all the moving parts, go forward at a greater speed than the piston travels in its reciprocating motion in the cylinder. Consequently the cross head and piston rod are constantly moving forward with reference to a fixed station, such as a telegraph post, on the line.

W. A. P. says: We have a 40 horse engine fed by two 50 horse tubular boilers, and we burn about eight tuns of coal per week, besides all the fuel made by our wood working establishment (which is enough to run most engines with the same amount of power that we use). The following will illustrate the situation. The engine makes 60 revolutions, and the distance




from the engine to main shaft, A, is about 100 feet. 1. Do we lose power by the long distance the power is transmitted? 2. Does it take more power to drive the intermediate counter, B, by the same belt than it would by belting back with another belt? 3. Could we get more power by moving the engine nearer the work, and carrying the steam through pipes? 4. How much would be lost by condensation if the pipe were well protected? 5. Do you think wire rope could be applied to advantage? Answers: 1. Yes. 2. Yes, if you could drive the countershaft with a smaller belt. 3. Yes, if the pipes were properly protected. 4. Probably not more than 3 per cent, if the connection were straight. 5. We would advise you to correspond with the manufacturers.

M. A. G. asks: What is bay rum? How is it prepared, and what are its uses? Answer: It is an alcoholic spirit distilled from the leaves of a species of laurel termed "bay tree"; extensively used on account of its peculiar and pleasant flavor by apothecaries.

S. A. asks: What is the best metal to use on the bottom of a small steamer in a southern or tropical climate? She is to carry about 30 tuns, and to draw about 4 feet when loaded, and to be used to tow vessels at times. We have a boat of iron; but the bottom has to be painted every 7 or 14 days, as the paint is rubbed off in crossing a sand bar from 2 to 6 times every day. We have thought of using heavy zinc plates below water line and sheet iron above; would they be durable? 2. What would be the best kind of tubes for an upright boiler, iron, brass, or copper, when salt water is used as feed for boiler and wood as fuel? Answers: 1. A light sheathing of wood, covered with copper, would answer very well. The wooden sheathing should be double. 2. Composition tubes would probably be the most durable for your boiler

G. G. asks why lithographic pictures can not be transferred by the Willis' process, described on p. 369, vol. 28. Answer: The Willis process refers to photographic pictures only.

A. M. asks for an explanation of the word "penny," as used to describe the sizes of nails, fourpenny, tenpenny, etc. Answer: It is a corruption. "Four pound," "tenpound," etc., is correct, and signifies the weight per 1,000 of the nails.

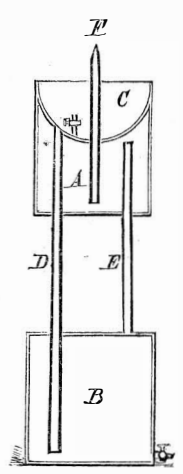
A. R. asks what are the number and dimensions of the tunnels and bridges on the Erie canal. Answer: The bridges are all 11 feet or more from the water. The published statements do not give their number.

C. E. H. says: I am building a small locomotive, and I fear my boiler will be too small. The dimensions of the cylinder are 2x1¾ inches; the boiler's length, not including smoke arch, is 20 inches and diameter 8 inches. Inside of fire box is 6x7x7 inches. There is one flue 2½ inches in diameter. The boiler is of 16 ounces copper. If my boiler is too small, can you suggest any way to remedy the evil of insufficient steam? Answer: You can reduce the diameter of cylinder by bushing it, or shorten the stroke by making the heads fit into the cylinder for some distance. By either method, you can get engines proportioned to the size of the boiler, without changing many of the parts.

G. P. S. says: I am a fireman on one of the dreaded brass engines, and all that I can do will not keep the hot brass from turning blue. I have used acid in almost every form, but with little success. Answer: Fine emery and oil, well rubbed in, will polish most brass work, but we are not sure that they act as specifics in every case.

A correspondent encloses a specimen of a grass growing largely in Mississippi, and asks: 1. Has it any commercial value? 2. The yellow pine tree of this country was never known to bud or sprout out from the stump after the tree was cut down, the stump dying and decaying very nearly as fast as the log; but there is a spot of land, in this place, of about five acres, that is thickly covered with pine, cedar, oak, and sweet gum trees, where about ten years since there were about a dozen of the pines cut down. The stumps have remained perfectly green, and the sap has continued to rise and fall yearly ever since; yet there are no sprouts or buds springing from them. Answers: 1. The grass might possibly be used in the manufacture of paper. Its commercial value would depend upon the cost of its preparation for the market. 2. If it is really sap that rises and falls in the pine stumps, we cannot account for it. But if the stumps are in a locality where they are kept continually wet, that would account for their preservation.

J. W. asks: Is there any simple and inexpensive method of forcing water through a small tube say three sixteenths inch bore, after the manner of a fountain? For instance, suppose I have a tank 3 inches deep that will hold a quart how can I force the water through the tube 6 inches above the level of the water in the tank? By placing the tank a foot above the top of the tube, I can get pressure enough, but that will not answer; I want to force it through the tube from below and have pressure enough to cause it to flow through a pin hole in the nozzle to the hight of an inch. Answer You can do it by employing compressed air in your reservoir; or you can easily make a "Hero's fountain," as represented in the sketch.




The operation of this fountain is as follows: The vessel, A, is first filled with water up to the top of the pipe, E. Then, by pouring water into the basin, C, the air in the vessel, B, is compressed, and the water in the vessel A, will be forced out through the jet, F, to a hight corresponding to the length of the tube, D, less the friction of the water in the discharge pipe.

G. K. asks: 1. Can steel be cast, as cheaply as forged, and of as good quality? 2. Is there a liquid, oil or spirit, that will not freeze, congeal, expand, or contract between 0° and 112° Fahr.? Answers: 1. Yes. 2. There is no liquid known to us that will not expand or contract by heat and cold.

T. C. W. says: Covington, Ky., has as fine water works as can be found in the United States. They are on the Holly system, and all the water is pumped out of a well on the bank of the Ohio river. The water is perfectly clear and has a good taste, but it is too hard. People cannot wash with it, even after it has been boiled. What shall we put in the water in order to make it fit for washing? A recipe to soften a barrel full of water at a time will oblige. Answer: Put in just enough milk of lime to take up the excess of carbonic acid, when the insoluble carbonate will be precipitated

B. S. asks: What is the best method of bringing water from a spring about a mile distant? The fountain head is about 15 or 20 feet higher than the reservoir. I would like to know whether wood, iron, cement, or pottery tubing would be the best. Answer: Wooden pipes would be the cheapest. They are well suited for conducting water.

S. H. N. asks if aluminum can be soldered or brazed to itself or any other metal, in such a manner that it will stand a twisting or bending pressure as well as any other metal. What flux must be used? "I can solder it, but not so as to stand the required strain." Answer: A good solder for aluminum has not yet been invented. Gold can be employed, we suppose, but cannot tell what strain it will bear. One great disadvantage attending the use of aluminum in alloys is its tendency to make them brittle.

W. P. asks: Is there any difference in the draft of a tug boat drawing a vessel or not, the tow line to be horizontal? Answer: We have an idea that the draft will be increased, up to a certain speed, when the tug is towing a vessel. Perhaps some of our readers who have made observations on this matter, will favor us with communications.

S. A. asks: Has vacuum any immediate action on the piston of an engine? Answer: Vacuum produced on one side of the piston of an engine, has precisely the same effect as an equal amount of pressure applied to the other side of the piston.

J. G. R. asks: How long does a current of electricity take to cross the ocean on the cable? Answer: One quarter of a minute is the time required to make an intelligible signal on the cable.

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F. D. H. asks: 1. How many Grove's cups are required to heat a fine platinum wire to redness? 2. Does it require quantity, or intensity of electricity to accomplish this result? Answers: 1. The electricity from a No. 1 cell of Grove's battery, if passed directly through a piece of platinum wire one quarter of an inch long and one four-thousandth of an inch in diameter, will heat it to redness. 2. Quantity.

J. M. W. asks: If gunpowder be enclosed in a very strong glass tube, leaving no waste space, and then exploded, would (provided the tube did not burst) all the powder explode? If it did, would the resulting gases remain as such, or would they be changed into a solid? In short, what would be the result of the explosion? Answer: We think this experiment has never been tried. If there were no waste space and no air in the tube, no explosion would take place, for although gunpowder contains in itself a quantity of oxygen sufficient for its combustion, the gases thereby produced must have room for expansion in order to produce an explosion. A patent was once taken in England for transporting gunpowder safely by placing it in airtight vessels filled with some neutral gas like carbonic acid, which does not support combustion. But this was a useless device. To ascertain the resultants from the explosion of a given quantity of gunpowder, the latter is commonly suspended within an iron globe several times larger than the charge, and the air is then exhausted. The powder is now fired by electricity, and the chemist ascertains the nature and quantity of the gaseous and solid products. The solids are mainly carbonate and sulphate of potash; the gases, nitrogen and carbonic acid. The sudden heating and expansion of the latter gives the mechanical effect.

J. K. asks (1) how to straighten a circular saw when it gets sprung. 2. Is there a chemical preparation to sharpen worn out files? Answers: 1. No instructions for straightening saws that will assist any one can be given. It is an art only attainable by practice. 2. There are various processes of using acids for sharpening files. I have tested three of them, but my experience is that they are more trouble than benefit. The cheapest way, all things considered, is to sell the worn out files and buy new ones. It will not pay even to get them recut, for filing tempered steel.—J. E. E., of Pa.

J. B. asks: What factory turns out the greatest number of locomotives? Answer: The Baldwin works, Philadelphia. Pa.

C. G. D. asks: 1. Does the law offering the reward for the improved canal boat for use on the Erie canal require the wheels and apparatus to be so constructed that the banks shall not be washed? 2. What does a boat cost, exclusive of engine and neeessary machinery? 3. Is it probable that this season will decide the question? Answers: 1. A device that would injure the banks of the canal would not be likely to take the State reward of $100,000. 2. A common canal boat costs, we believe, about $1,000. 3. This season will probably decide the reward question.

E. McD. asks: Is there such a blessing as a clockwork fanning machine, for keeping a body cool? Answer: Yes, any quantity of them. Makers will do well to advertise them in the SCIENTIFIC AMERICAN.

G. H. asks: If I make the cores of a common sized electro-magnet extend ⅛ inch beyond the end of the spools in front, will the magnetism be as strong at the poles, when a current excites the cores, as though the cores were not extended? Answer: No, the magnetic force will be a trifle less.

C. H. H. asks for a method of covering pulleys with leather. What sort of leather and what sort of glue should be used? Answer: Ordinary belt leather will answer quite well. Secure it to the face of the pulley with small belt rivets. For information as to the process lately described in the SCIENTIFIC AMERICAN, address the patentee.

J. O. E. says: 1. An engine pump is 6 inches in diameter and 1½ feet stroke. The sucker is a flat one. When all the air is shut off, it makes a loud crack in the pipes, as if it was going to break everything to pieces. 2. What is the best solution to make solder adhere to old copper pipes and to tin? Answers: 1. We cannot answer this, as we do not know what our correspondent means by the air being shut off. 2. For soldering copper pipes, use sal ammoniac or chloride of zinc. For tin, resin or chloride of zinc.

W. E. F. says: We use 8 cords of pine (Jersey) wood daily. Price $3. Nut hard Schuylkill coal can be delivered at $7.25 a ton. Which is cheaper? Answer: The wood is probably the cheaper fuel of the two. If your furnace is so constructed that you can burn wood or coal without change, you might try the experiment. General results sometimes fail to be realized in special cases; and whenever the test of experiment can be readily applied, it should be done.

J. E. W. says: In your reply to V. M. K. regarding the relative power of the same machine with either a 20 inch or 10 inch driving pulley at the same surface speed, did you not lose sight of the extra friction produced in the journals by the necessarily closer hug of the belt to the smaller pulley in order to transmit the same power? Answer: In each case the belt is transmitting the same amount of power, and consequently has the same strain, as its speed is unchanged.

B. says: A cubic foot of anthracite weighs about 95 pounds. Will some one state the number of cubic feet per tun of the various sizes in common use, "nut," "stove," "egg," etc.? By measuring the coal bin, we can then decide whether we have full weight or not. Answer: From the average weights of a great variety of coals, we obtain as a mean result, for broken coal of almost any size: Anthracite, 38 5, and bituminous, 40, cubic feet per tun of 2,000 pounds. Probably many of our readers may have made observations on weight and bulk of different kinds of coal, and if they will send us their figures, specifying kind of coal, size, and weight in pounds per cubic foot, we will tabulate them, and publish them in our columns. If a sufficient number of replies are received, we shall be enabled to form a very interesting and valuable table.

E O. W. asks what is the best substitute for nitro-glycerin for blasting purposes? Answer: Dynamite is a good substitute for, or a rather a safer means of using, nitro-glycerin. If you want a powerful and dangerous explosive, use picrate of potash, either alone or combined with an equal quantity of saltpeter.

M. M. W. asks: How many pounds pressure does the water, (coming from the reservoir in your city) exert at the outlet of a half inch faucet? Answer: This depends upon the amount of water in the reservoir, the part of the city, and the hight of faucet from ground. It varies every hour in the day. The fact that Croton water is often able to rise, in pipes, to the fifth floor of a house will enable you to get some idea of the pressure, remembering that a column of water 33 feet 9 inches high exerts a pressure of 15 lbs. to the square inch.

J. C. asks how many revolutions per minute an engine 6x18 inches must run to get the most power? Answer: The speed at which you can run the engine, provided you have sufficient boiler power, depends upon how well the running parts are balanced. If the engine is well designed in this respect, 100 revolutions will not be too fast.

J. P. L. asks how to tin small brass articles. Answer: The process employed in tinning small brass articles, such as pins and hooks, is to boil them in a solution of one part cream of tartar, 2 parts alum, and 2 parts common salt, in 12 parts of water. In this bath is placed a sufficient quantity of granulated tin. They can afterwards be polished with sawdust or bran and tow.

A. P. asks: 1. Is there any cheap substance known which, mixed with water, will make the same evaporate more rapidly, at the ordinary temperature, than the water would of itself? 2. Has any one metal the property of making water evaporate from its surface more rapidly than another? Answer: We should advise you to employ vacuum pans or some other method of diminishing the pressure of the atmosphere, if heat can be used. If not, keep the air in rapid circulation. If the quantity is small, place it under a receiver, and near it place fused chloride of calcium or oil of vitriol. If the quantity is large, try the German method with brine, called graduation.

R. F. says, in reply to R. A. C., who asked for a remedy for bleeding at the nose: I will give one obtained from Dr. Gleason during a course of lectures; it is a vigorous motion of the jaws, as if in the act of mastication. He advised us, in the case of a child, to make a wad of paper, put it into the child's mouth, and instruct it to chew it hard. Of course an adult does not need the paper. It is the motion of the jaws that stops the flow of blood. This remedy is so simple that people sometimes laugh when I recommend it, but I have never known it to fail in a single instance, even in very severe cases.

MINERALS.—Specimens have been received from the following correspondents, and examined with the results stated:

J. W. S.—The specimen is chiefly mica, with a little felspar. It has no value.

J. R.—We think it is corundum.

G. S. K.—Iron pyrites. Their only use is in making oil of vitriol.

C. D. M.—Copper pyrites.

D. Van B.—Tourmaline.

J. McM.—Quartz; of no especial value. Perhaps agates, suitable for mounting as ornaments, may be found in that locality.

J. J. F.—The rock you send contains some pyrites, iron, alumina, silica, etc. An assay will cost $10 or $15.

J. D. A.—Limestone.

DELTA sends us a specimen of chrome red (American vermilion) and asks how it can be prepared. Answer: Liebig and Wöhler state that it is best prepared by fusing together, at a very low red heat, equal parts of potassium and sodium nitrates, gradually pouring into the fused salt small quantities of chemically pure yellow chromate of lead. After cooling, the insoluble chrome red is washed and dried. It is then a magnificently colored, cinnabar-like crystaline powder. Professor Dulong prepares chrome red by precipitating a solution of acetate of lead with a solution of chromate of potassa to which caustic potassa has been added. Various shades from deepest to palest vermilion red are caused by the difference in size of the constituent crystalline particles. According to Dr. Duflos, its formula is $2PbO, CrO_3$.

## COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On an Auroral Phenomenon. By J. D. B.

On Pressure Gages and Safety Valves. By E. D. S.

On the Natural Rights of Inventors. By T. W.

On Iron Steam Yachts. By J. H.

On Retardation of the Earth's Rotation. By J. H.

On Fresh Water Crayfish. By J. S.

On the Patent Discussion. By E. A. B., by M. J. and by M. J. D.

On Embryology. By J. L.

On Mechanical Elements. By F. M. McM.

On the Roper Engine. By H. S. W.

Also enquiries from the following:

T. R. J.—A. O.—J. S. T.—C. R.—B. L.—R. L. S.—A. M.—J. P. D.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

# Index of Inventions

FOR WHICH

## Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

## June 24, 1873,

AND EACH BEARING THAT DATE.

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## APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

25,565.—ROLLING MILLS.—J. & G. Fritz. September 10.
25,569.—BEDSTEAD SLATS.—T. Howe. September 10.
25,572.—MOLDING WATER TRAP.—J. A. Lowe. Sep. 10.
25,586.—BURGLAR ALARM.—A. Q. Ross. September 10.
25,588.—STEAM PUNCHING MACHINE.—J. Sparrow. Sep. 10.
25,640.—STEAM BOILER.—J. Harrison, Jr. September 10.
25,683.—HYDRANT.—C. L. Stacy. September 17.
25,796.—JACQUARD MACHINE.—A. Babbett. October 1.
27,539.—GUN BARREL.—J. H. Burton. September 10.

## EXTENSIONS GRANTED.

24,531.—GAS RETORT.—W. Beaumont.
24,563.—COUCH FOR RAILROAD CAR.—C. Knight.
24,588.—HAY SPREADER.—J. C. Stoddard.

## DESIGNS PATENTED.

6,711 & 6,712.—CENTER PIECES.—B. Dreyer, Phila., Pa.
6,713 to 6,720.—CARPETS.—A. Heald, Philadelphia, Pa.
6,721.—JEWELRY BOX.—E. C. Moore, Yonkers, N. Y.
6,722.—FURNITURE.—T. W. Moore *et al*, New York city.
6,723.—LOCK FRONT.—E. J. Steele, New Haven, Conn.
6,724.—DRAWER PULL.—L. Widmayer, New Britain, Conn.
6,725.—BARBER'S FOOTSTOOL.—F. J. Coates, Cincinnati, O.
6,726 to 6,733.—STOVE PLATES.—S. H. Ransom, Albany, N. Y.
6,734.—HANDLE SOCKET.—J. S. Ray, East Haddam, Conn.

## TRADE MARKS REGISTERED.

1,329.—MEDICINE.—F. W. Barnum & Co., Danbury, Conn.
1,330.—VARNISH BRUSH.—E. Clinton & Co., Phila., Pa.
1,331 & 1,332.—PLUG TOBACCOS.—Liggett *et al*, St. Louis, Mo.
1,333.—WINES AND LIQUORS.—Morrow & Co., N. Y. city.
1,334.—COSMETIC.—W. T. Wenzell, San Francisco, Cal.
1,335.—STOCKING SUSPENDER.—C. A. Shaw, Boston, Mass.
1,336.—PAINT.—H. P. Webb, New York city.
1,337 & 1,338.—OILS.—Devoe Manufacturing Co., N. Y. city.
1,339.—FOUNTAIN PUMP.—J. A. Whitman, Cranston, R. I.

## SCHEDULE OF PATENT FEES:

| | |
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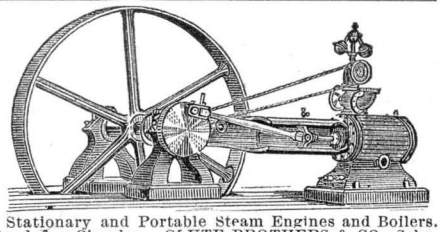

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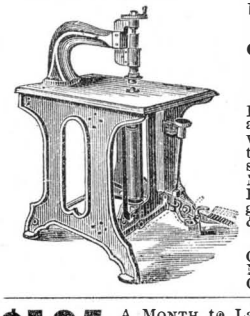

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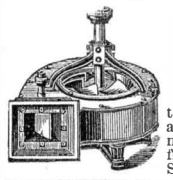

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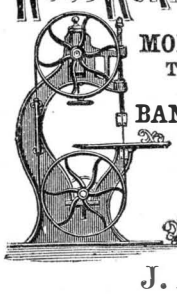

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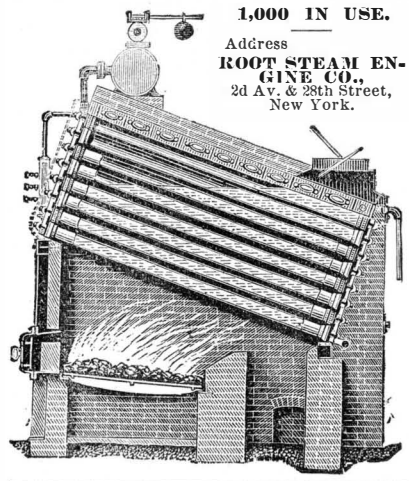

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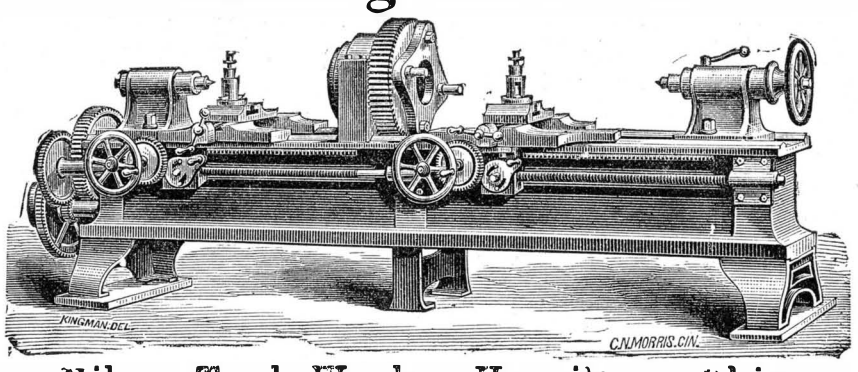


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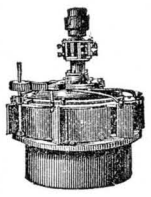

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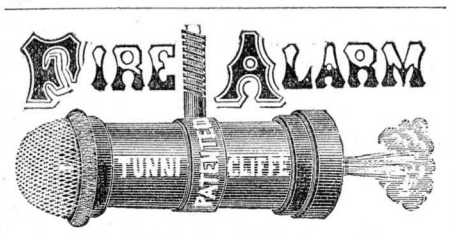


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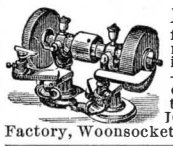

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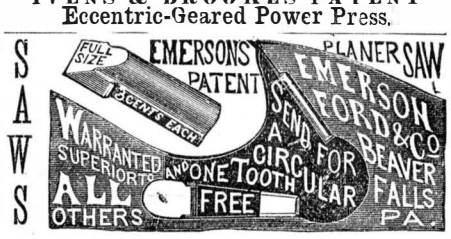


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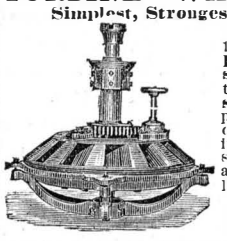

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